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Abstracts. Initialled abstracts in the present number are by T. N. Hoblyn, H. L. Pearse, W. S. Rogers and H. Shaw, of the East Malling Research Station.

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Horticultural Abstracts

Vol. VIII

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MISCELLANEOUS.

*Growth promoting substances.**

930. BRASE, K. D. 577.15.04 : 631.535

Synthetic growth substances in the rooting of softwood cuttings of deciduous fruits.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 431-7, bibl. 4.

Kieffer pear and *Prunus tomentosa* showed some increase in the rooting of their softwood cuttings after the cuttings had been treated with indolebutyric acid. In Montmorency cherry increased rooting was obtained with the aid of indolebutyric acid when the cuttings were taken shortly before the shoot growth had become completely woody. The addition of potassium permanganate even in the weakest solutions always resulted in injury. It is clear that different species and varieties within the species respond in different ways to treatment with indolebutyric acid and so far even when successful the results are still remote from commercial application.

931. BIALE, J. B. AND HALMA, F. F. 577.15.04 : 634.3

The use of heteroauxin in rooting of subtropicals.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 443-7, bibl. 3.

The minimum effective concentration for rooting single citrus leaves, mature and immature cuttings of citrus and other subtropicals is a basal application of .01 per cent of heteroauxin. The range, however, varies between species and between 3 types of cuttings of the same species. The chief manifestation of heteroauxin effect is in the number of roots, but the effect is more evident in species which root readily. The time of year and the tree's physiological condition when the cuttings are taken must also be considered in the evaluation of heteroauxin effect on cuttings. During the experiments from which these conclusions are drawn it was observed that tender and immature cuttings of seedlings of certain trees such as the cherimoyer rooted easily without treatment, whereas mature or immature cuttings from grown trees failed to root.

932. TRAUB, H. P. 577.15.04 : 551.566.15

Growth substances with particular reference to subtropical fruit plants.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 438-42, bibl. 7.

Over 100 compounds were tested for activity in root formation with *Passiflora quadrangularis* or *Bignonia venusta*. Nearly 50% were very successful. These are listed, together with their degree of success over the controls compared with that of .02% indolebutyric acid, and the most suitable concentration for each. Only eleven were tested for *Avena* coleoptile curvature and none caused any bending except indolebutyric and indoleacetic acid. In a systematic study of the effect of growth substances on the stem, leaves and fruit of *Passiflora* indolebutyric acid at .05 and .02% concentrations caused injury to tender tips if the cutting bases were soaked therein for 24 hours. Treated stem cuttings with leaves removed do not root so easily or strongly as those still bearing their leaves. Tendrils treated at tip and base did not form roots but fell rapidly into senescence. *Passiflora* species which die down to the ground during winter, e.g. *P. incarnata*, root less readily with treatment than the evergreen varieties. Other subtropical fruits responding readily to hormone treatment are *Cyphomandra*, *Carissa*, citron, and lemon. Tardy response was obtained from white sapote, guava, Surinam cherry and rose apple. Mango and avocado have so far failed to respond. Leaves of *P. quadrangularis* or even portions of

* See also, 1074, 1206, 1337, 1338.

leaves root if planted basal end down in a normal rooting medium but not at all if treated with indolebutyric acid of .05 or .02% concentration. Petioles minus the leaf blades, however, require the treatment at top and base before they will root. Various citrus fruits and *Passiflora* fruits when soaked in hormone solutions gave reactions. Soaking in .05% solution accelerated, whereas very dilute solutions delayed senescence. Callus in some cases formed on the cut surface of the pedicels or, if the receptacle and calyx were removed, on the pericarp tissue in the region of the calyx and scar. In the case of the long jointed pedicelled *P. antiguensis* roots were formed at the base of the pedicel. The difficult sweet orange when supplied with a grafted head of the easily rooting citron and planted as a cutting in ordinary rooting medium formed abundant callus but no roots. The sweet orange controls produced no response at all. Apparently the factor for callus formation was transmitted and not that for roots.

933. STUART, N. W., AND MARTH, P. C. 577.15.04 : 635.976.84

Composition and rooting of American holly cuttings as affected by treatment with indolebutyric acid.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 839-44, bibl. 1.

With American holly (*Ilex opaca*) wounding the cutting stems by splitting upwards about $\frac{1}{4}$ inch by 2 right angled cuts and 18 hours standing in 0.01% indolebutyric acid resulted in 100% rooting in 23 days. The propagation bed was electrically bottom-heated with thermostatic control at 80° F. The cuttings were also covered with a glass light and shaded. Deferred treatment with indolebutyric acid at 0.01% of both wounded and unwounded cuttings, which had not rooted after 76 days in the cutting bed, resulted in a vigorous rooting response in 21 days. The wounded cuttings gave much the better response, the roots appearing on the edges of the wounds. The effect of indolebutyric acid on the carbohydrate content of the holly cuttings was studied. The stems of treated cuttings maintained a higher percentage of total sugar than the untreated stems until extensive root growth occurred which caused a withdrawal of sugar from the leaves of treated cuttings. In both treated and untreated cuttings there was a gradual decrease in starch content in the cutting beds.

934. SKINNER, H. T. 577.15.04 : 635.939.124

Rooting response of azaleas and other ericaceous plants in auxin treatments.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 830-8, bibl. 5.

Cuttings of many ericaceous plants which rooted satisfactorily without special treatment usually gave a higher percentage of rooting when treated with indolebutyric acid. Indoleacetic acid was less effective. A mixture of peat and sand was a better rooting medium than sand or peat alone.

935. DuBUY, H. G. 577.15.04

A method for extracting growth substances from pigmented tissues.

J. agric. Res., 1938, 56 : 155-8, bibl. 12.

The author describes a new method by which he claims that a more precise determination of the actual amount of growth substances in pigmented plants can be made than has previously been possible. The main new feature would appear to be the initial use of solid CO₂ for freezing the tissue to be examined, which prevents the activity of oxidizing agents.

936. POPP, H. W., AND McILVAINE, H. R. C. 577.15.04 : 581.035

Growth substances in relation to the mechanism of the action of radiation on plants.

J. agric. Res., 1937, 55 : 931-6, bibl. 10.

Turnip seedlings irradiated by an unscreened mercury vapour lamp or subjected to this radiation as screened through 3 types of Corning glass filters were found to contain less growth substances as determined by the Went method than controls kept in total darkness. Since the degree of stunting of the seedlings was correlated with reduction in growth substances and since growth substances are known to exert a controlling influence on stem elongation, these results are believed to support the thesis that the stunting effect of radiation upon plants may be at least partly attributed to the inactivation of growth substances.

937. COOPER, W. C., AND WENT, F. W. 577.15.04 : 631.535
Effect on root formation of retreating cuttings with growth substances.
Science, 1938, 87 : 390.

Whereas the cuttings of grapefruit and sweet orange respond very little to having their bases soaked in .01 to .05% water solutions of various root growth promoting substances for 24 hours, it has been found that re-treating such cuttings at varying periods after the initial treatment does result in further root formation. Thus with Hamlin sweet orange cuttings the untreated lot produced no roots after 6 weeks in a propagating frame with bottom heat ; cuttings initially treated with .02% indole-3-acetic acid produced 1 to 2 roots, but cuttings re-treated 3 weeks after the initial treatment produced 3 to 6 roots. Similar results have been got with papaya and camellia. Experiments with other plants including avocado and mango are now in progress.

938. GOLDBERG, E. 577.15.04 : 635.34
Root and shoot production induced in cabbage by beta-3-indole-acetic acid.
Science, 1938, 87 : 511-2.

Paste containing 30 mg. beta-3-indole-acetic acid was applied to decapitated, first internodes of young seedlings. This treatment resulted in the production, not only of an apical ring of adventitious roots, but also of viable shoots. The exact processes involved are discussed.

939. VEGIS, A. 577.15.04 : 585.39
Premature sprouting induced by heteroauxin. (Indolyl-acetic acid.)
Latv. biol. Biedr. Raksti, 1937, 7 : 87-102, bibl. 35.

Heteroauxin (indolyl-3-acetic acid) treatments resulted (even when small amounts of very weak concentrations were used, e.g. 250 ccm. 1/409600 mol solution for ten turions) in a premature sprouting of dormant *Stratiotes aloides* turions. Experiments proved that only in stronger solutions of heteroauxin (over 1/6400 mol) is the sprouting partly due to the acidity of the corresponding solutions, whereas in solutions of lower concentrations it is solely due to the typical effect of heteroauxin anion. However, a certain supporting influence of the typical effect of heteroauxin upon the higher concentration of hydrogen ions was undoubtedly established. Turions treated with heteroauxin as a rule started sprouting during the first 24 hours, while those put into hot baths or treated with a solution of salt sprouted only after 3-4 days. The effect of the latter treatment led to the same results, although the effect of heteroauxin was quicker and more direct. From this the author concludes that the various methods of breaking the dormancy all induce, though possibly in different ways, the formation of the necessary growth substance or its activation in buds. Turions placed in phosphate solutions of relatively high acidity started sprouting almost as soon as those placed in heteroauxin solutions. This leads to the conclusion that the growth substance may be present in the turions, while they are in an enforced state of rest, but is inactive or bound up, until acid is supplied from outside, which makes it active. It is considered that inactivation of the growth substance in bud cells may possibly be attained through metabolism by raising the concentration of H ions.

940. HUBERT, B., AND BEKE, A. 577.15.04 : 631.535
Beworteling van stekken onder invloed van heteroauxine. (Rooting of cuttings with the aid of heteroauxin.) [Dutch, English summary pp. 2.]
 Reprinted from *Meded. LandbHoogeschool, Ghent*, Deel 6, No. 1, 1938, pp. 58, bibl. 21.

The effect of synthetic heteroauxin solution treatments on rooting of various cuttings has been studied for some time in the Physiological Department of the Ghent Botanical Laboratory. A fresh standard solution was prepared for each experiment. The concentrations were :—0, 25, 50 and 100 mg. per litre. The cuttings were placed with their basal parts in the solutions for 4, 6, 8, 22 or 24 hours and were then potted in pure quartz sand. In several cases the concentrations proved decidedly toxic, the stalks becoming soft and slimy. In less toxic solutions the average number of roots and the percentage of rooted cuttings was reduced. Tap water treatments proved advantageous for several species and injurious for others. A second series

of controls was therefore used in which the cuttings were potted at once. Experiments with *Viburnum Tinus* showed that magnesium sulphate ($7H_2O$) and calcium chloride added to the heteroauxin solution (100 mg. per litre) in low concentrations (0.1-0.01%) had no influence on the rooting response of the cuttings. A tap water heteroauxin solution proved to be less effective than distilled water heteroauxin solution. (Ghent tap water contains much calcium bicarbonate, while the pH varies between 7.3 and 7.6.) The study of the influence of pH on heteroauxin treatment has not been completed. The number of roots on *Aucuba japonica* increased in proportion to the number of leaves left on the cuttings during treatment with heteroauxin (100 mg. per litre). Only little importance is attached to photosynthetic influences in winter, while transpiration is believed to be an important factor. The root length of *Aucuba* was only slightly, if at all, affected by heteroauxin treatment. *Viburnum Tinus* showed an increase of root length at certain concentrations, while at the highest concentration shorter roots were produced. *Helichrysum rupestre* and *Iresine Lindenii* developed a great number of roots, measurements of which were taken. When *Iresine* was treated with strong solutions of heteroauxin its roots tended to become shorter, while with *Helichrysum* the opposite was the case. However, cuttings of the latter plant also tended to produce shorter roots after treatment with 100 mg. per litre. A maximum response of *Iresine* was obtained from treatment with 50 mg. per litre, while *Helichrysum* did not reach its maximum response even after the treatment with 100 mg. per litre. Basal cuttings of *Vitex Agnus-castus* and *Morus alba* rooted better than apical cuttings. The cuttings of *Morus alba* showed very pronounced bud inhibition after heteroauxin treatment (100 mg. per litre). *Vitex Agnus-castus* showed a very complicated response. The trials with *Vitex* had to be discontinued owing to lack of material. Results are shown graphically and by photographs.

941. LOCKE, S. B., RIKER, A. J., AND DUGGAR, B. M. 577.15.04 : 632.314
Growth substance and the development of crown gall.
J. agric. Res., 1938, **57** : 21-39, bibl. 47.

Plants, mainly tomato, inoculated with a virulent form of *Phytomonas tumefaciens*, showed not only gall development but also responses suggesting an increase in the amount of growth substances present. These responses included increased epinasty of leaf petioles, increased initiation of adventitious roots, stimulation of cambial activity, inhibited development of certain buds and delayed abscission of senescent leaves. It is suggested that the growth substance so far detected in crown gall is more likely to be of the auxin-a or auxin-b type than of the heteroauxin type and more probably a product of the host cells under the influence of the bacteria than a direct bacterial metabolic product. [From authors' summary.]

942. WENT, F. W., BONNER, J., AND WARNER, G. C. 634.33 : 577.15.04 : 631.535
Aneurin and the rooting of cuttings.
Science, 1938, **87** : 170-1, bibl. 4.

Leafy lemon cuttings were treated overnight with indoleacetic acid (200 mg. per litre) and were stood for a week in sand. Their bases were then put for 24 hours either in water or in an aneurin (vitamin B_1) solution (1 mg. per litre). Thirteen days later the control (water-treated) cuttings had 8.1 roots apiece while the aneurin-treated cuttings had 16.3 roots each. The entirely untreated controls showed only 0.3 roots per cutting. Results with leafy camellia cuttings were even more striking. These experiments show that aneurin, the root growth hormone, if applied at the appropriate time after initiation of roots by auxin, greatly increases the root development of cuttings and may hence become as important in nursery practice as are the auxins themselves.

943. NAGAO, M. 577.15.04
Studies on the growth hormone of plants. II. Effect of heteroauxin on the growth of *Helianthus hypocotyl*.
Sci. Rep. Taihoku Imp. Univ., 1937, **11** (4th Ser.) : 447-60, abstracted in English (19 lines) in *Jap. J. Bot.*, 1938, Vol. **9**, No. 2, abstr. 225.

943. BEAL, J. M. 577.15.04 : 635.935.722
Histological responses of three species of *Lilium* to indoleacetic acid.
Bot. Gaz., 1938, **99** : 881-911, bibl. 10.
 HAMNER, K. C. 577.15.04 : 586.641
Histological responses of *Mirabilis Jalapa* to indoleacetic acid.
Bot. Gaz., 1938, **99** : 912-54, bibl. 16.

944. GUSTAFSON, F. G. 577.15.04 : 581.163
Induced parthenocarpy.*
Bot. Gaz., 1938, **99** : 840-4, bibl. 9.

Attempts, some successful, to induce parthenocarpic fruits are here described. Among methods tried and referred to are the following :—treatment of ovaries of various plants, e.g. egg plants, with lanolin paste containing the residue of a chloroform extract of pollen ; treating the pistil with known chemicals such as indolepropionic, indoleacetic, indolebutyric and phenylacetic acids mixed into a paste with lanolin ; treatment of the cut ovaries from unopened flower buds with 5% indolebutyric, indoleacetic or pyrroleacetic acid ; application of pollen after reduction of stigmatic surface by removal of some of the lobes. The results of experiments show that the pollen grain contains a growth promoting substance and also that the ovules may contain growth hormones, which may stimulate growth. That fruits can now be produced artificially by supplying growth promoting substances to the ovary has been shown. Whether this method can have any practical application remains to be seen.

945. BLAKESLEE, A. F. 547.944.6 : 631.523
Doubling chromosomes by means of colchicine.
Gdnrs' Chron., 1938, **103** : 270-1.

This short article is in answer to the numerous enquiries on the use of colchicine which have been addressed to the Department of Genetics, Carnegie Institute of Washington, Long Island, N.Y. The form used is colchicine alkaloid amorphous U.S.P., selling for about 25 dollars an ounce. The drug is used in attempts to double the number of chromosomes in plants. Too much should not be expected from the method, since some forms with doubled chromosomes are inferior to the normal types. Furthermore, the first effect of treatment is to dwarf the plant and malform its leaves and branches. It is only in the second generation that pure races with doubled chromosomes can be expected. Full information on the method is given in the article, Blakeslee, A. F. and Avery, A. G. Methods of inducing doubling of chromosomes in plants. By treatment with colchicine. *J. Hered.*, 1937, **28** : 393-412, *H.A.*, **8** : 322.

Propagation.

946. LAWRENCE, W. J. C., AND NEWELL, J. 631.531 + 631.532/5
Experiments on seed and potting composts.
Gdnrs' Chron., *Lond.*, 1937, **101** : 287 (I) ; **102** : 67-8 (II) ; **102** : 393 (III) ;
 1938, **103** : 149 (IV) ; **103** : 428-9 (V).
 LAWRENCE, W. J. C.
Further experiments on composts for plants.
 Reprinted from *J. Guild Trade Horticulturists*, Sept. 1938, pp. 11.

I. As a result of experiments with potting composts which have been carried out at the John Innes Horticultural Institution for a number of years, two standard composts have been evolved which, it is claimed, will obtain better germination and seedling growth and will grow plants to a better perfection than the wide variety of mixtures generally used. The first series of experiments described was made to gain information as to the relative values of 3 phosphatic fertilizers when added to composts for seed sowing. The composts consisted of 2 parts good sterilized loam, 1 part moss-peat, 1 part coarse sand. The points to note are :—(1) The poorer growth obtained

* See also *H.A.*, **8** : 635.

when chalk is added in the absence of phosphate. (2) The better growth obtained when either superphosphate of lime, bone meal or bone flour are added in the absence of chalk. (3) The poorer growth obtained when bone meal or bone flour are used in the presence of chalk. (4) The greater availability of the phosphate in superphosphate compared with bone flour and bone meal. (5) The best results are obtained when superphosphate is added with chalk. The rate of application of chalk was $1\frac{1}{2}$ oz. per bushel. II. Tests as to the optimum physical condition of the seed compost revealed that while the compost mentioned in part I was ideal, the actual proportions of loam, peat and sand were of less moment than the addition of superphosphate. No matter what the physical condition of the compost germination and growth were improved when superphosphate was added. III. Soil sterilization by heating often results in a severe temporary check to the seedlings. It was found that this check occurred when the recommended compost was sterilized after mixing, but that if the ingredients were sterilized separately the check was very moderate. The addition of superphosphate to the mixture of the separately sterilized ingredients almost entirely eliminated any check. If the sand and moss-peat is clean and free from weeds there is no need to sterilize them for ordinary gardening purposes. IV. Soil sterilization kills all soil pests and diseases and alters the character of the soil by increasing the available nitrogen. If in excess the increase may have a distinctly harmful effect on young seedlings. It is found in practice that a temperature of 212° F. maintained for about half an hour is adequate. The remainder of section IV describes various methods of sterilizing suitable for the amateur and gives notes and prices of certain proprietary soil sterilizers of the small portable type. V. The question of the influence of the quality of loam in potting soils is discussed and the answer from the experiments carried out is that the quality of the loam is of little consequence provided fertilizers have been added and the compost is in good physical condition. A useful pamphlet which compresses into 2 pages the formulae and instructions for using the composts and practical notes on soil sterilization has been published by the John Innes Horticultural Institution, Merton, under the title "Improved composts for pot plants". In the second paper, which is a lecture recently delivered to the Guild of Trade Horticulturists on composts and soil sterilization, certain modifications of the methods originally advocated are embodied. The standard compost for potting is now medium loam 7 parts by bulk, moss-peat 3, coarse sand 2; to each bushel of this mixture is added $1\frac{1}{2}$ oz. hoof and horn meal $\frac{1}{8}$ " grist (13% nitrogen), $1\frac{1}{2}$ oz. superphosphate of lime (16% phosphoric acid), $\frac{3}{4}$ oz. sulphate of potash (48% pure potash), and 1 oz. ground limestone or chalk. This compost is suitable also for raising all but the smallest seeds. With certain crops, e.g. chrysanthemums and tomatoes, the peat may be reduced by a considerable amount. The balance of fertilizers used in this compost has been the subject of a good deal of research and the author states that he has been unable to improve upon it.

947. CHAPMAN, H. D., AND LIEBIG, G. F. 581.084.2 : 634.3 + 635.64
Adaptation and use of automatically operated sand-culture equipment.
J. agric. Res., 1938, 56 : 73-80, bibl. 3.

Both citrus seedlings and tomato plants grew excellently in the authors' automatically controlled culture installations flushed hourly during the daylight. Details of two such installations are given. The nutrient solution is circulated by means of compressed air-operated ejector-type pumps. A clock-controlled magnetic valve in the air line provides for periodic, automatic pumping. Various experiences relating to iron supply and frequency of flushing are discussed and the excellent results obtainable with such equipment are noted.

948. ROBBINS, W. J., AND SCHMIDT, M. B. 635.64 : 581.144.2
Growth of excised roots of the tomato.
Bot. Gaz., 1938, 99 : 671-728, bibl. 37.

For a review of the literature on the growth of excised roots in sterile culture or of plant tissue culture the reader is referred by the author to White's article entitled Plant tissue cultures. *Bot. Rev.*, 1936, 2 : 419. The authors give here a detailed account of the growth of excised tomato roots in liquid media. The roots were from germinated seeds of a pink-fruited variety

from Mexico, Ajo de Verrado No. 580. The possibility of unlimited growth in White's solution composed of mineral salts, sugar and yeast extract was confirmed, all three parts of this medium being essential. It was also apparently possible in a solution of mineral salts, cane sugar and vitamin B, or thiazole. The reactions of the roots to substitutions or additions to the medium are noted and discussed. Light was found to be unnecessary.

949. CHOUARD, P. 631.588.1 : 631.544 + 577.15.04
 L'origine et le développement de nouvelles techniques de forçage dans
 l'horticulture française. (The origin and development of new methods of
 forcing used in French horticulture.)
C. R. Acad. Agric. Fr., 1938, 24 : 391-7, bibl. 14.

The author reviews modern forcing innovations under the following headings:—*Electrical heating*. This includes heating by means of isolated cable and a combination of ordinary manure and heating with electric cable. Both of these methods ensure greater regularity of heat than manure alone. Practice has shown the surprising suitability of electric heating for seed boxes, striking of cuttings and forcing such things as endive, melon, etc. *Radiant panels*. Here the plants are in the open air, between two walls of cement kept warm by hot water pipes or between two panels warmed by electricity. The air remains cold but the plant warms up and forcing is thus possible without shelter. *Electric lighting*. This includes neon lighting, incandescent light of average calibre and, latterly, the use of low power light for increasing length of day. The last method has been used to accelerate flowering in long day plants and to retard it in short day plants. *Growth promoting substances*. The use of growth promoting substances holds out great promise but is merely in its infancy. The necessary treatment varies with each plant and time of treatment. Results are sometimes unexpected. *Flower promoting substances*. The author has shown that certain animal hormones, such as dihydrofolliculine, have a stimulating effect on china asters. This effect is noticeable only when light is deficient. With optimum or excessive light the effect vanishes. This would indicate that photoperiodism activates flowering hormones of a type analogous to folliculine. The author gives a number of references to French articles on the above subject and draws attention to the more complete bibliography given by him in his report to the 12th International Horticultural Congress at Berlin, August 1938.

Nutrition.

950. THOMAS, W. 631.8 : 581.192 : 581.144.4
Foliar diagnosis : application of the concepts of quantity and quality in determining response to fertilizers.
Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 269-72, bibl. 6.

The author discusses the method of Lagatu and Maume for calculating the response to fertilizers during growth by means of the analysis of leaves of the same physiological age, in which the two magnitudes, representing the quantity and quality of nutrition, are considered simultaneously. The quantity or intensity of nutrition of the leaves consists of the sum ($N + P_2O_5 + K_2O$) of the elements present at sampling expressed as a percentage of the dried material. The quality is the ratio of the amount of each element (N, P and K) present at sampling to the amount of each other element present (N, P and K). The application of the method is also considered and illustrated by the author from potato fertilizer trials at the Pennsylvania Agricultural Experiment Station.

951. P.B. 631.8 : 546.3
The rôle of metals in plant nutrition.
Gdnrs' Chron., 1938, 104 : 67-8.

The part played by metals in plant nutrition is discussed and it is pointed out that with one or two exceptions very little is known of the individual influences of the minor elements. The form in which the metals occur in the soil is no less important than their presence. In highly inert and insoluble complexes their dissolution might be so slow as to create a deficiency, and

in highly soluble form and in the absence of a material capable of absorbing them they might equally justly be considered in danger of being lost through leaching. A compound which has recently appeared on the market under the name Pacteron Fertimetel consists of a solution of low concentration of a large number of minor metallic elements in iron which in itself is in a metallic or slightly oxidized state. Analysis revealed the presence of silver, aluminium, boron, barium, calcium, chromium, manganese, lead, silicon, strontium, titanium, vanadium and tungsten, with 62% of solvent iron, 2.7% of inert diluent and about 10% of combustible matter. The form consists of exceedingly fine particles or films, intermingled with or smeared upon the surface of inert non-metallic particles, the function of which is to prevent undue agglomeration of the particles of metal. Additions of 1% of this agent to ordinary fertilizers will, it is claimed, materially assist in making good the normal deficiency in minor metallic elements commonly exhibited by such compounds.

952. SELMAN, I. W.

631.828

On the use of common salt as a fertilizer.

J. Minist. Agric., Lond., 1938, **45** : 237-46, bibl. 25, reprinted *Gdnrs' Chron.*, 1938, **103** : 434-6, 451.

The value of common salt as a fertilizer in agriculture has been the subject of many conflicting statements and much confusion in the literature of the subject during the last and present centuries. Some of the reasons for this are given. The effect of sodium chloride on the soil and its effect upon the physiology of the plant are discussed, knowledge on the latter having been greatly advanced by the development of modern plant physiological technique during the past ten years. In summarizing the author shows:—*Response of soils to sodium chloride*. Useful.

(1) Potassium may be liberated from many clay soils and then will become available for utilization as a plant nutrient. (2) A deflocculation of the clay particles is brought about, and this is useful on relatively light soils, tending to increase the water-holding capacity of those soils. Disadvantageous. (1) The top soils of loams and clays may tend to become unduly sticky, particularly in wet seasons, making cultivation difficult. *The effect of sodium chloride on the plant*. Useful. (1) The sodium ion has been demonstrated to be a useful, though not always an essential, plant nutrient. The response of plants that are tolerant to salt may be expected to be controlled by the levels of the other plant nutrients in the soil. (2) It is uncertain whether the slight superiority of sodium chloride over potassium chloride for sugar beet is due to the effect of salt on the soil or its action in the metabolism of the plant. (3) There is some evidence that sodium chloride increases the drought resisting properties of the leaves. Disadvantageous. (1) Chlorides exert a harmful effect on the yield and quality of potatoes.

953. ASHBEEL, D.

551.573

Evaporation in Palestine.

Palestine J. Bot., 1935/36, issued 1937, **1** : 3 : 8-26.

Measurement of evaporation throughout the year at different times of day was made in different climatic regions of Palestine by means of the Piche tube, and the readings are here discussed. Evaporation is relatively low along the sea coast but rises considerably in the Southern Steppic zone and in the Dead Sea basin. In all regions evaporation greatly exceeds the moisture brought by annual precipitations, thus making life difficult for plants with an extended growth cycle. Evaporation is exceptionally high during the blowing of the hot and cold Scirocco winds and it is essential that plantations of sensitive plants should be protected against their desiccating effects.

954. ROBERTS, R. H., AND STRUCKMEYER, B. E.

612.014.44 : 581.02

The effects of temperature and other environmental factors upon the photo-periodic responses of some of the higher plants.*

J. agric. Res., 1938, **56** : 633-77, bibl. 12.

The use of temperatures a little above or below those normally used in the greenhouse altered the photoperiodic responses of a number of plants tested including poinsettia, Klondike cosmos,

* See also H.A., **8** : 344.

rudbeckia, soybeans and Maryland Mammoth tobacco. The effects of other environmental treatments indicate that the blossoming state results directly from the nature of the internal condition of the plant rather than from any specific external treatment. Root development was related rather to the foliage character of the top than to the photoperiod treatment. [From authors' summary.]

955. BARNES, S. 631.586 : 631.432.2
Soil moisture and crop production under dry land conditions in Western Canada.
Publ. Dom. Canada Dep. Agric., 595, 1938, pp. 43, bibl. 43, being *Fmrs' Bull.* 46 and *Revis. Bull.* 130.

The results of 12 years' experimental work on soil moisture conservation and utilization at the Dominion Experimental Station, Swift Current, Sask., are here reported. Most of the data were obtained from crops grown in water-tight tanks 15" in diameter and 5' in depth which were weighed at regular intervals. Summer-fallowing has resulted in an average conservation of 29.1% of the precipitation. This figure varied from 20.7% to 41.6% depending on the time and nature of the precipitation, generally being higher in years of high rainfall. Winter precipitation had very little effect on the amount of moisture conserved, for very little water enters the soil when the ground is frozen. When the soil was dry, moisture from showers of $\frac{1}{4}$ " or less was generally lost by evaporation within a few days and thus did not appreciably increase the amount of moisture in the soil. The growth of weeds very considerably reduced the moisture conserved by summer-fallowing. When weed growth was checked by surface cultivation, the time of ploughing the summer-fallow had very little effect on the moisture conserved, and the effect of such cultivation in conserving moisture was as great as that obtained by ploughing or deep cultivation. Crops grown on summer-fallow frequently secured more moisture from the supply stored in the soil than from the seasonal rainfall. Maize and sunflowers grown as summer-fallow substitutes used practically all of the soil moisture. During years with a low rainfall, the amount of water required to produce 1 lb. of dry matter was considerably higher than in years of high rainfall. All crops used practically the entire amount of soil moisture available irrespective of the season. Russian thistle had a lower water requirement than any of the plants studied. Notes are given of the requirements of and use of water by wheat and other cereals, brome grass and sweet clover, sunflowers and other crops.

956. CHADWICK, L. C., BUSHEY, D., AND PLETCHEN, G. 581.144.2
Root distribution studies.
Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 734-8, bibl. 4.

The observations were made on *Carpinus japonica* (Japanese hornbeam) and on *Ulmus americana* and *U.a.Moline* (American and Moline elms). With *Carpinus* the type of soil profoundly influenced both root and top growth. For transplanting the elms the plants could either be dug by combing out the widespread lateral roots so that the fibrous roots bunched at the ends would remain intact, or the ball might approach a radius in feet corresponding to the diameter of the trunk in inches. Cultivation under the trees by which the surface roots are cut by the cultivator causes considerable changes in the nature of the root system.

TREE FRUITS, DECIDUOUS.

General.

957. WICKENS, G. W. 634.1/8
The fruit industry in Western Australia. Fruit production and export.
J. Agric. W. Aust., 1937, 14 : 327-31.

This article is interesting as giving not only the exports and imports of fruit from and to Western Australia in the year July, 1936-June, 1937, but also figures of the entry of fruit trees and plants during that period and the acreage and production of fruit and vines in Western Australia in the season 1935-6.

958. BAGENAL, N. B. 634.23

The Kent cherry orchards : their management and crops.

J. Minist. Agric., Lond., 1938, 45 : 323-30, bibl. 1.

A historical review of cherry growing on brick earth soils in Kent is given. The varietal question is considered from a commercial grower's viewpoint, brief notes being given on some of the most popular black and white cherry varieties grown in the county. At one time in this county cherries were planted in hops and when the latter were grubbed the land was sown down to grass pasture for grazing sheep. Thus arose the tradition of high farming for cherries and this tradition has been the secret of successful cherry growing. A period of 40 years of cropping starting at the age of 10 is not considered unusual in Kentish cherry orchards, and a yield of from 5-15 "halves" (or 140-420 lb.) per tree, according to age and circumstances can be reasonably expected.

Varieties and breeding.

959. LESYUK, E. A. 634.11-1.523

Mitchurin apple varieties. [Russian.]

Sci. Fruitgrowing, Mitchurinsk, 1938, No. 2-3, pp. 33-41.

Mitchurin's apple varieties have been studied for some 5 years at the Mitchurin Central Genetic Laboratory. As a result a number of these apple varieties are here named as showing one or more of the following characteristics:—early bearing, small or large fruit drop, high scab resistance, high percentage of high grade fruit. The tests have led to the elimination of a certain number of varieties.

960. CHERNENKO, S. F. 634.11-1.523

New apple crosses. [Russian.]

Sci. Fruitgrowing, Mitchurinsk, 1938, No. 1, pp. 39-47.

Descriptions are given of some new but already well established apple hybrids obtained by the author.*

961. ZAYETS, V. K. 634.11-1.563 + 664.85.11

Flavour, appearance and keeping quality of American, Central Russian and Mitchurin apple varieties. [Russian, English summary 1 p.]

Sci. Fruitgrowing, Mitchurinsk, 1938, No. 1, pp. 54-8.

For three years storage tests have been carried on with American, Central Russian and Mitchurin apple varieties at the Orlov branch station of the Mitchurin Research Institute. The fruit has been stored for three months (December, January and February) in ordinary cellars at temperatures ranging between some +2° C. and +4° C. The flavour was determined by means of organoleptic tests at the time when the majority of fruits reached an optimum degree of maturity. As the result of preliminary observations it has been possible to group the apples concerned according to storage quality, flavour and appearance. It is concluded that most of the best old commercial Central Russian varieties are inferior to American and to Mitchurin varieties in these respects.

962. TSEKHMISTRENKO, P. E. 634.11-1.524

The best apple hybrids at the Mleev Experiment Station. [Russian, English summary, $\frac{1}{2}$ p.]

Sci. Fruitgrowing, Mitchurinsk, 1938, No. 1, pp. 59-62.

In 1929 breeding apples for hardiness, high productivity, late maturity and fine flavour was started at the Mleev Experimental Station (Ukraine). For this purpose various crabs, including specimens of *Malus baccata*, *M. serotina*, *M. violescens*, *M. Soulardii* and hardy Russian varieties, were crossed with the best large-fruited European and American apple varieties. Some 46,000 hybrid seedlings have been raised so far. These seedlings represent a series of 401 combinations

* See also "Selection work and new apple varieties" by Chernenko (Selkhozgiz, 1933).

obtained by crossing 49 mother varieties with 81 pollinator varieties. Many reciprocal crosses have also been made, the best of them being noted here. The hybrid seedlings are raised under severe field conditions, and the final selection takes place during the first 3-5 years of fruiting of the seedlings. Thus, in the last two years, 29 hardy, large-fruited varieties with different dates of maturity (summer, autumn and winter) and producing fine quality fruit have been selected. Six named crosses are noted as showing particular promise. These appear to be very hardy, since they did not suffer from frost injuries even during the severe winter of 1935 (thermometer registering approximately $-37^{\circ}\text{C}.$).

963. TARASENKO, G. G. 634.11-1.524
Mitchurin's Bellefleur Kitaika as initial material for selection. [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1938, No. 2-3, pp. 42-7. ✓

Apple seedlings raised from the seed of Bellefleur Kitaika have been studied for some time at Detskoye Selo, in order to determine whether they form a suitable initial material for selection. The total number of seedlings raised after elimination of unhealthy plants was 156. No. 59 and No. 32 seedlings, having many valuable characteristics, are described. Besides these two seedlings, which are being propagated for commercial purposes, there are several other promising seedlings under observation. Their main characteristics are given in tabular form.

964. SAVIDGE, C. 634.11 : 663.3
An investigation into the behaviour of certain cider apple varieties.
J. Minist. Agric., Lond., 1938, 45 : 570-9.

This is a tabulated report of the investigations started in 1931 into cropping, growth characters and certain pathological features of 21 cider apple varieties. Data indicate wide variations in the growth and cropping of the varieties, the main reason for this variability being the resistance or susceptibility of certain varieties to apple canker or apple scab. Spraying in winter and spring effected a marked increase in cropping, health and vigour of most varieties. The observations on the incidence of red spider mite suggested that it was unwise to continue yearly applications of tar-oil without applying lime sulphur during the post-blossoming period. Further, since woolly aphid infestations have also increased, special control measures were found desirable in future. As a result of spraying there was an average yearly profit on the six acres under supervision of £7. 7s. per acre at the end of six years. This result was considered very satisfactory, in view of the fact that the trees were still not in full bearing and that it was an orchard of mixed varieties.

965. LOSOVSKY, T. A. 631.52 : 634.1/7
Selection and propagation of various fruit and small fruit varieties. [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1938, No. 2-3, pp. 57-64.

This is a report for 1937 of the work carried out by the Mitchurin Institute of Fruit Production. Figures are given of the different plant material sent by this institute to different places in U.S.S.R.

966. TANAKA, Y. 634.22
A monograph of *Prunus Mume* with reference to its fruiting varieties.
 [Japanese, English summary, pp. 5.]
Contr. hort. Inst. Taihoku Imp. Univ. 22, 1936, pp. 44, bibl. 24.

Prunus Mume varieties have been grown hitherto in Japan mainly for ornamental purposes and only a few varieties have been cultivated for use as preserved fruit. In the present publication exact data are given of investigations conducted at the Okitsu Imperial Horticultural Experiment Station (Japan) on the morphological and cultural characters of some 60 varieties and of their comparative value as a source for preserved fruits. The material used came from all parts of Japan. A synoptic key to the *Mume* varieties is given. As a result of the study 3 large-fruited varieties, 2 medium-sized-fruited varieties and 2 small-fruited varieties were found suitable for growing commercially under Okitsu conditions.

967. TIKHONOV, N. N. 634.22 : 581.143.7
Usuri [Manchurian] plum at the Barnaul Branch Station of Fruit and Small Fruit Production. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 8-9, pp. 75-6.

As a result of breeding work started in 1927 several hardy plum seedlings were raised at Barnaul (Siberia) from seeds obtained from the Vladivostok region. Descriptions of these seedlings are given. It is interesting to note that Usuri plum, usually considered to be very susceptible to drought, became sufficiently hardy under Barnaul conditions, where there is only a small yearly rainfall.

968. POTAPENKO, YA. I., AND ZAKHAROVA, E. I. 634.1/2 : 581.144/5
The flowering biology of fruit trees and the acceleration of fruiting in seedlings.
 [Russian, English summary $\frac{1}{2}$ p.]
Sci. Fruitgrowing, Mütchurinsk, 1938, No. 4, pp. 8-23.

In order to achieve a more rapid fruiting of seedlings they should be forced by a change of certain conditions to pass more rapidly through the different phases of the yearly cycle. In the present experiment approximately two cycles were obtained in one year with apple seedlings, *Malus baccata* and cherry seedlings, *Prunus Chamaecerasus* Jacq. [No account is given of the experiment with cherry seedlings.—ED.] The study made with 3 *Malus baccata* seedlings taken from a lot of 3-year-old seedlings raised under the same conditions is described here as follows:—In mid-February 1936 the seedlings were transferred to a glasshouse, lumps of frozen earth being left on the roots. Here the seedlings started growth. On 18 April, 1936, they ceased growing and were subjected from 21 April, 1936, onwards to low temperatures ranging from $+3^{\circ}$ C. to $+5^{\circ}$ C. In the beginning of July 1936 the 5th growth period of the seedlings started. This period was passed under various light conditions:—One of the seedlings received light continuously (daylight+electric light), while the others received no additional lighting. In October 1936 all 3 seedlings were again subjected to low temperatures and in January 1937 were induced to initiate their 6th growth period in the glasshouse. The commencement of this period might have been further hastened if it had been so desired, but it was actually postponed to January, since before then glasshouse conditions were unsatisfactory for seedling development. In this growth period starting in January 1937 one of the seedlings (that which had received continuous light treatment during the past vegetative period) flowered and formed 10 fruits. Two months after the beginning of this period the seedlings ceased growth and entered dormancy, and approximately 1 month after this the fruits [on one of the seedlings.—ED.] turned red and leaves began to fall. Thus, in the course of 11 months the seedlings completed 2 cycles of development which usually require a period of two years and one of the seedlings bore fruits in the 4th year from the time of seed germination. The controls did not flower in their 5th year and will consequently not bear fruit earlier than in their 6th year. Other experiments are noted in which it was found possible to induce other seedlings planted in pots and receiving additional lighting to pass their 5th vegetative period in the 3rd year after seed germination, but no fruits have so far been borne. [It is not stated if flowering took place.—ED.]

Rootstocks.

969. LINCOLN, F. B. 634.11-1.541.11-1.534
Layering of root grafts—a ready method for obtaining self-rooted apple trees.
Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 419-22, bibl. 2.

A method is described by which self-rooted apples are obtained by root grafting them on seedling rootstocks and layering the scion shoots by mounding as they emerge. The original scion as distinct from the scion shoot can be left in the ground to produce further shoots for layering. Only one shoot per graft is produced the first year and it is suggested that two or more might develop, if dwarfing or somewhat incompatible grafting roots were used.

970. LINCOLN, F. B. 634.11-1.541.11
Improvements for stock testing to make the results more comprehensive.
Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 426-30.

At present half the States in U.S.A. are carrying out rootstock trials on deciduous fruits, yet the results can never be co-ordinated owing to differences in environment, cultural practices, etc. A recognized standard of full performance capacity of individual apple varieties under favourable conditions is needed for comparison in rootstock trials with tree fruits. The use of this Standard of Performance of various clones should determine how nearly these varieties are approaching perfection under favourable conditions. The data obtained, however, will be the product of a complex of conditions of constantly varying magnitude of influence, over a period of years as well as of the present, conditions moreover which are not equivalent at the several stations. To get over this a Standard Integrant should be chosen of which the performance at various stations will give an idea of the degree of justification in combining data for deductions or might even lead to a scheme of corrections which would give each station an equivalent rating. Suggestions are made as to the most suitable variety to fill the qualifications required of the Standard Integrant. It is also suggested that self-rooted trees should be the base of comparison for stock/scion combinations and that unworked stocks be included in all tests to learn their natural habits of growth. Apple stock trials should supply basic knowledge of lasting value and not merely cater, as at present, for transitory vogues in stocks or scions, cultural practices or apple producing regions, all of which constantly change.

971. MARGOLIN, A. P. 634.11-1.541.11
Dwarf rootstock selection in U.S.S.R. [Russian, English summary $\frac{1}{2}$ p.]
Sci. Fruitgrowing, Mitchurinsk, 1938, No. 2-3, pp. 81-94.

Since 1935 rootstocks have been studied by the Ukrainian Fruit Research Institute with a view to finding suitable dwarfing stocks for fruit trees in U.S.S.R. The experimental material was obtained from 3 foreign and 12 Russian research institutes. As a result 7 types of the rootstocks examined were found to correspond to the Malling types II, III, IV, VI, VIII, IX, V, and three further types of stocks (Mitchurin Paradise, Crimean and Baba-arabskaya) which did not correspond to any of the Malling types. Dwarfing stocks known in the Crimea under the name of "German Doucin" and Kosolapovskaya or Lipetskaya paradise in Lipetsk were identified as one and the same type III. Type IX and II were found particularly suitable for the Southern regions of U.S.S.R., and II and III for Central and Northern Russia. No data are as yet available on the suitability of VIII, V and VI. Further work will embrace careful propagation of clonal stocks tests of certain stocks possibly suitable as dwarf rootstocks, testing of certain dwarf stocks for hardiness and drought resistance, biological and physiological studies carried out simultaneously in Ukraine, Crimea and Caucasus, searches for new dwarf forms among wild fruit trees and various other points.

972. MEIER, K., AND BRYNER, W. 634.11-1.541.11
Versuchsergebnisse mit typisierten Unterlagen zur Heranzucht von Apfelhoehbüschen. (Experiments with clonal rootstocks for highbush apple trees.)
Schweiz. Z. Obst- u. Weinb., 1938, 16 : 303-11 and 17 : 321-31.

This is an illustrated report of Swiss trials, in progress since about 1932, of the Malling type apple rootstocks. The rootstocks studied were types I, II, IX, XII and XIII, and the scions used were Gravensteiner, James Grieve, Bedfordshire Foundling, Reinette gris de Vignat and Glockenapfel. Certain definite conclusions which have already been reached, include the following :—Of the 1-year-old layers from the stool bed which were planted out type I and XIII showed the best growth, the growth of IX and II was moderately good, while XII showed the most losses. XII does not root readily, and it is suggested that this type might with advantage be spurred prior to transplantation. The vegetative growth made agreed with East Malling experience with the exception of XIII which should come between I and XII, but under Swiss

conditions has shown different results with different varieties. The scions appeared to influence growth appreciably. Gravensteiner, James Grieve, Bedfordshire Foundling and Glockenapfel formed the finest heads on I and XII while Reinette gris de Vignat and Champagne Reinette showed the best growth on II and XII. The amount of roots formed by the various types also appeared to depend on the scion variety used, though observations on the essential character of the roots confirmed Hatton's experience. The greatest difference from his experience was found in type II, which produced more fibrous roots in Switzerland than in England.

973. VYVYAN, M. C. 634.11-1.541.11

The relative influence of rootstock and of an intermediate piece of stock stem in some double-grafted apple trees.

J. Pomol., 1938, 16 : 251-73, bibl. 8.

The performance of four series of double-worked apple trees has been followed for six years. The trees were double-grafted at a single operation and consisted of three portions: the scion (Stirling Castle), an intermediate piece of stock stem, and a root system belonging to a piece of stem (rootstock). [Rootstock consisting, as is the English custom of a root system and a short piece of stem.—ED.] The stocks used were Malling No. XII (very vigorous) and No. IX (dwarfing), which were combined as root system and intermediate in all four possible ways, A (XII/XII), B (IX/XII), C (XII/IX) and D (IX/IX). The trees on No. XII root systems produced significantly more wood growth and significantly fewer total fruit buds and fruit buds per metre wood than those on No. IX root systems. The trees with No. XII intermediates produced significantly more wood growth and significantly fewer fruit buds per metre wood than those on No. IX intermediates. Differences in total fruit buds were not significant. There was significantly more wood growth and there were fewer total fruit buds where stock and intermediate were of the same variety than when they were different. This significant effect of interaction may have been due to the nature of the graft unions, though not necessarily so. The difference in fruit bud per metre wood was not significant. Pronounced swellings occurred above graft unions where the lower component was No. IX and the upper Stirling Castle or No. XII. The swellings were morphologically different in these two cases. No swellings occurred above unions between like components or between Stirling Castle and No. XII. The cross section of the intermediate was determined by the rootstock below it, and that of the rootstock by the intermediate above it. As a result the No. IX intermediate in trees of type B became larger than the stems of the No. XII stocks below. [Author's summary.]

974. SOUTHWICK, L. 634.11-1.541.11

Malling stock influence on fruit size and shape.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 359-61, bibl. 6.

Certain known rootstocks are shown to be probably responsible for measurable differences in form and size of apples produced by their McIntosh scions.

975. YERKES, G. E., SUDDS, R. H., AND CLARKE, W. S. 634.11-1.541.11

Growth and fruitfulness of three apple varieties on French crab seedlings and on a clonal stock.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 363-8, bibl. 10.

A clonal stock (designated as T-200) was developed from a selected seedling for the purposes of the experiment and 800 plants were raised in the second season. These were budded in 1927 with Delicious and Winesap at Morgantown and with Stayman Winesap at the State College, Pennsylvania. Comparable plantings on French crab seedlings were made at the same time. Comparisons for uniformity after 11 years showed Delicious on the clonal stock to be more uniform and of nearly the same size as on the seedling stocks, Winesap to be more uniform but more dwarfed, while the Stayman Winesap at State College was more variable in growth and yield and much more dwarfed than the seedling.

976. STUART, N. W. 634.11-1.541.11 : 632.111
Cold hardness of some apple understocks and the reciprocal influence of stock and scion on hardness.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 386-9, bibl. 8.

The paper presents data on the cold hardness of the roots of a number of apple varieties used as rootstocks. The method of testing for cold resistance is based on the theory that exosmosis of electrolytes from frozen apple stems and roots is proportional to the amount of freezing injury. Roots from 25 varieties generally used as scions all proved harder than the roots of French crab seedling and this hardness was of the same general order as the generally accepted hardness of the tops. The hardest roots contained slightly more sugar and less moisture than the tender roots. The total ash content of the roots had little or no influence on the amount of electrolytes released from the roots by exosmosis after freezing. It is shown that the scion influences the hardness of the rootstock, though not always in the direction of the scion degree of resistance; e.g. Wealthy, the hardest of a series of scion varieties on rootstocks from a single clone, rendered its rootstock the tenderest of the series. On the other hand no scion variety had its hardness influenced by the hardness of the stock.

977. ANTHONY, R. D., SUDDS, R. H., AND YERKES, G. E. 634.23-1.541.11
Orchard tests of mazzard and mahaleb cherry understocks.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 415-8, bibl. 4.

Comparisons of mazzard and mahaleb as cherry rootstocks have been in progress for several years in Virginia and Pennsylvania. Differences in growth and productiveness have developed and mazzard is indicated as the better stock of the two. In Virginia on a clay loam over a rather hard and too retentive clay subsoil mahaleb induced earlier and heavier bearing but the trees died within 10 years while those on mazzard survived in good condition. In West Virginia, on a fertile silt loam well drained, two sources of mahaleb produced different results as regards girth; in one case being almost equal to and in the other being definitely inferior to mazzard. Trees on mahaleb from both sources outyielded mazzard by 60 to 1 and 157 to 1 respectively owing to their greater precocity. In another orchard of 122 Montmorency trees, half on mazzard and half on mahaleb, the trees grew excellently on both stocks. Those on mazzard are, however, much the larger. Records of yield, which has been light so far, do not show significant differences. On well drained silt loam at State College, Pennsylvania, Schmidt trees on imported mahaleb were more severely injured by winter cold than those on Virginia mazzard.

978. TUKEY, H. B. 631.541.11 + 631.541.12
Stock and scion terminology.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 378-82, bibl. 5.

The author endeavours to standardize some horticultural terminology. The word stock is ambiguous and should not be used without a qualifying adjective. The term rootstock is well established and should always be used. The present method of giving clonal rootstocks a number prefaced with a name indicating place of origin should be continued unless the stock already has a well established horticultural name. The use of the word vegetative when clonal is meant is deprecated as confusing in view of the other meanings commonly applied to the former word. In speaking of seedling varieties of rootstocks the word seedling should always follow the name, thus for instance, the nature of French crab seedling stock is thus distinguished at once from Virginia crab stock which is a clone. Stock-scion combinations are to be indicated by an oblique separating line instead of more cumbersome expressions of which the author quotes two. Thus Baldwin worked on Malling I would become Baldwin/Malling I or a case of double working would be, say, Jonathan/Virginia crab/French crab seedling. Budding is to be used for budded plants still in the nursery. Seedling rootstock is not to be used unless the stock has been worked, otherwise it is to be seedling or seedling for rootstock. The combination of stock and scion, however propagated, is to be known as stion, and hence American horticultural literature of the future is to be embellished with such expressions as "stionic effect",

'stionic relation" or just "stionics". After the first shudder the convenience must be admitted. Uniform and uniformity are generally taken to refer solely to size and habit of growth. This practice should now cease. Uniform used alone must imply uniformity in a considerable number of different characters, form, appearance, quantity, quality, and so on. If uniformity in one or two respects only is meant a qualifying phase must be used, e.g. uniform as regards growth habit. Hardiness does not necessarily refer to power to withstand cold but includes resistance to all exacting conditions. If resistance to cold is meant the term winter hardy is preferable. The term vigour must not be taken to imply size or degree of development, a small plant may be vigorous while a larger one may be weak. More exactitude is required and this may be obtained by the use of the expressions fast growing, strong growing, weak growing and slow growing.

Pollination.

979. ZAYETS, V. K. 634.11 + 634.13 : 581.162.3

Inadequacy of physiological methods in pollinator tests. [Russian.]

Sci. Fruitgrowing, Mitchurinsk, 1938, No. 4, pp. 24-35.

This is a tabulated report of pollination trials carried out for several years by the Mitchurin Research Institute. The following conclusions were reached:—By adding parts of the pistils to the pollen of different apple and pear varieties a higher percentage of pollen growth and an increased growth of pollen tubes in sugar solution was recorded. The effect of the presence of parts of the pistil of any variety was almost the same on pollen growth of the same variety as on that of other varieties of the same strain. This was not found to depend on the relative fertility of the respective varieties. The pollen of different varieties of apples and pears showed strong positive reactions to the introduction to the solution of the pistil from quite different plants, having no close botanical relations to apples and pears. Thus, parts of the pistil from sloe, plum, bird-cherry, lilac, honeysuckle, lily-of-the-valley, pansy, yellow acacia, dandelion and carnation stimulated pollen growth of different pear and apple varieties no less than those from varieties with which they usually cross well. It is, therefore, thought that the presence of some parts of the pistil from any plant will always stimulate the pollen growth of any plant. This leads to the conclusion that with regard to their effect on pollen of different plants in artificial conditions the secretions of the stigma and pollen grain from different plants are identical to many plants and are not characteristic of a variety or a strain, as is assumed by the working hypothesis of physiological method. In view of the identical effect of this introduction of parts of the pistil from any species on the pollen of any variety of plant, irrespective of the degree of compatibility between them, the physiological method of determining the degree of self-fertility of a variety and of testing pollinating capacity is regarded as inadequate, since it is based on erroneous theoretical principles. Artificial fertilization in the field is at present the only reliable method of testing pollination capacity.

980. BUGINI, F. 581.163 : 634.1/2-1.541.11

Parthenocarpia e apogamia nelle piante arboree da frutto. (Parthenocarpy and apogamy in fruit trees.) [English summary.]

Riv. Frutticoltura, 1938, 2 : 183-200, bibl. 20.

Parthenocarp is defined by the author as the faculty of a plant to produce fruit without seeds. He discusses the experiments made by Ewert, Kobel and others, and especially the work being done by Morettini at the Horticultural Research Station at Milan. This has concerned pears and apples and has aimed at the discovery of varieties which can be depended upon to yield fruit without pollination by insects. He accepts Ernst's definition of apogamy who speaks of apogamy occurring when the embryo arises without fertilization from a diploid cell, i.e. one with a double chromosome complement as opposed to parthenogenesis in which the embryo develops from a haploid cell or one with a single chromosome complement. In both cases a complete fruit containing seeds is the result. Apogamy is shown to be transmissible, i.e.

genetically fixed. Work is taking place at the Milan Research Station on the subject and the hope is expressed that eventually among varieties showing this characteristic and being therefore capable of uniform reproduction from seed there will be some which will make good rootstocks for peaches.

981. TANAKA, Y., AND YAMASHITA, T. 634.16 : 581.145
Observations on the flowering and fruiting habit with the loquat, *Eriobotrya japonica* Lindl. [Japanese, English summary 25 lines.]
 Reprinted from *Agric. and Hortic.*, 1937, 12 : 823-9, bibl. 9.

The fruiting and flowering habits of the loquat have been studied for some time at the experimental orchard of the Taihoku Imperial University, Japan. The following conclusions have been reached :—(1) The compound fruit bud of the loquat is formed at the end of the current year's shoot, from which over one hundred flowers develop, if the inflorescence is large. (2) The flowers at the outer position of the central part of the inflorescence unfold first. (3) The blooming order of each lateral cluster of the inflorescence is almost regular. It starts with the central or terminal flower after which the other flowers open in succession from the bottom to the top. (4) External factors (temperature, rainfall) have but little effect on fruit setting under subtropical climatic conditions. (5) Within the same inflorescence, flowers blooming earlier were found to give a higher setting. More fruits were set by the clusters formed on spring shoots than on the shoots of the same tree that had been formed later. (6) The authors recommend for subtropical districts cutting back the autumn shoots but leaving several buds at the bottom, thus securing good spring branches for the next crop.

982. SISA, M. 634.16 : 581.162.3
Pollen germination trials with *Eriobotrya japonica*. [Japanese.]
Agric. and Hortic., 1936, 11 : 2145-54 and 2369-86. Abstracted in German (16 lines) in *Jap. J. Bot.*, 1937, Vol. 9, No. 1, abstr. 96.

Growth and nutrition.

983. VAIDYA, V. G. 634.11-1.541.11 : 581.192
The seasonal cycles of ash, carbohydrate and nitrogenous constituents in the terminal shoots of apple trees and the effects of five vegetatively propagated rootstocks on them. I. Total ash and ash constituents.
J. Pomol., 1938, 16 : 101-26, bibl. 17.

It is noted in the introduction that the paper forms one of three on the cycles of the constituents of the three most important groups concerned in nutritional processes, namely, ash, carbohydrate and nitrogenous constituents of terminal shoots of apple trees. The author details the methods used in dealing with his material namely Lane's Prince Albert apple trees on Malling II, V, VII, IX and B rootstocks. Samples of the terminal shoots, consisting of 60-70 shoots from 8 trees on each stock were collected at monthly intervals over an 18 month period from January to June, being taken always between 10.30 and 11.30 a.m. under favourable weather conditions. For analysis they were divided into wood, bark and leaves. Determinations were made of :—mean length of shoots, dry matter of shoots, ash, lime, magnesia, potash, phosphoric acid and certain minor ash constituents in wood, bark and leaves. The chief constituents showed definite seasonal cycles in all parts of the shoot, but the remainder did not. Autumnal migration was established of dry matter and ash constituents in leaves and bark especially potash and phosphoric acid. Rootstocks were found to affect tree size, ratios of bark, wood and leaves in shoots and chemical composition of terminal shoots. The seasonal cycles for ash and phosphoric acid on stock IX were about 1 month earlier than those on the other stocks. Further trees

on IX showed a significantly higher lime content in wood, bark and leaves than those on other stocks. A low potash content was found for stock IX, while that for the other stocks agreed with their known susceptibility to leaf scorch under low potash conditions. Phosphoric acid showed a negative and magnesia a positive correlation with vigour. The magnesia value was negatively correlated with the known order of precocity of the rootstocks, the magnesia values for IX and VII being very low. IX showed extreme values for ratios of ash constituents when compared with other stocks, thus indicating that the chemical composition of the annual shoots on IX differs from that of the same variety on other stocks.

984. SMYTH, E. S. 634.11-1.541.11 : 581.192
The seasonal cycles of ash, carbohydrate and nitrogenous constituents in the terminal shoots of apple trees and the effects of five vegetatively propagated rootstocks on them. II. Carbohydrate fractions and lignin.
J. Pomol., 1938, 16 : 185-200, bibl. 8.

This is the second paper in the series of which Vaidya's was the first (see previous abstract). The author summarizes as follows : "The seasonal cycles of carbohydrate constituents and of lignin in the terminal shoots of apple trees (var. Lane's Prince Albert) grafted on Malling stocks II, V, VII, IX and B, have been determined in the bark, wood and leaves, with the objects (1) of discovering the effect of the various stocks on the composition of the shoots, and (2) of comparing the results with previous work by the writer on seasonal carbohydrate cycles. Sampling methods were similar to those described in the previous paper. Chemical methods were also similar, with the exception of a revised method for starch which avoided the acid hydrolysis previously used after enzyme digestion. Total alcohol soluble matter, reducing sugars, sucrose, total sugars, starch, hemicellulose, cellulose and lignin were determined. The results showed that there was great uniformity in the cycles of all the fractions for all the stocks. Starch and hemicellulose tend to accumulate from the end of June onwards more rapidly in IX than in the other four stocks, leading to a higher winter content. The cycles showed the same characteristic features as those described for Newton Wonder on II in the earlier work, both in form of cycle and order of content of substances in the tissues."

985. MICKLEM, T. 581.145.1/2 : 634.1/7
Studies on fruit bud formation in deciduous fruit trees in South Africa. I, II and III.
J. Pomol., 1938, 16 : 201-9, bibl. 18, 209-16, bibl. 11, 216-23, bibl. 15.

Part I. *Growth and fruit bud differentiation in some varieties of deciduous fruits.* By dissection of the fruit buds of Japanese plum, apricot, peach, apple and pear at different dates it was possible to trace the internal development of fruit buds up to the resting period. Results are tabulated showing the dates at which seven defined stages of development were reached. Differentiation was found to occur shortly after the cessation of shoot growth except in the Kieffer pear, when it was just before the cessation. Observations of other workers in the southern hemisphere are compared.

II. *The effect of pruning and shading on fruit bud differentiation and growth in the Peregrine peach.* Neither in 1934-5 nor 1935-6 did different pruning treatments, i.e. short or long pruning influence the time of fruit bud differentiation. Shading from May to September caused substantial increase in shoot growth. Shading of both long- and short-pruned trees stimulated leaf bud development.

III. *Some effects of winter oil sprays on fruit bud formation and leaf bud development in the Bon Chrétien pear.* Experiments were made both at Stellenbosch and at Groot Drakenstein in 1935 on the effect of dormant application of oils to pear trees. At Stellenbosch the application of 5% emulsions of raw linseed oil and a proprietary oil Pestridol advanced the initiation of fruit bud formation by 2-3 weeks. Half trees sprayed showed less leaf buds remaining dormant, more fruit spur formation, increased shoot growth and greater leaf area and number of leaves

per fruit spur on 2-year-old wood than the unsprayed halves. At Groot Drakenstein dormant spraying with 5% raw linseed oil, 5% seal oil and 5% and 3% Kleenup resulted in increased cropping and fruit bud formation on young and old wood.

986. GOURLEY, J. H. 581.145 : 634.1/7
Meristems and fruit bud formation in relation to general horticultural practice.
Bot. Gaz., 1938, **99** : 845-53, bibl. 8.

The chief interest of the horticulturist in the meristematic areas at the ends of shoots, i.e. in buds or bud potentials, is to know how field practices bring about or inhibit flower formation and so, later, fruit set and development. The writer notes that confusion frequently exists between blossom formation and fruit set and he urges the necessity for remembering that these two phenomena are entirely different and depend on different factors. He notes the following conditions as associated with flower formation : selection of varieties with a tendency to flower regularly, ringing of trunk or branches, bending of branches out of upright position, root pruning, fruit thinning, use of dwarfing stocks, low water supply at time of initiation of floral primordia (this period lasts for about 2 months in Eastern U.S.A. and has its peak in July), abundant leaf surface. Situations likely to limit flower production are : excessive vegetative condition at critical time resulting in a carbohydrate and possibly hormone deficiency during the time of flower initiation, heavy pruning, shading, defoliation. He discusses the following factors rather more fully, nitrogen and orchard culture, ringing, thinning, water and pruning. He suggests that an abundance of functioning green foliage is the key to success. It is because the orchardist permits exhaustion of food reserves and neglects provision for nutrients or catalysing substances, selects unfavourable soil or site or fails to maintain healthy foliage that there is failure to form flowers or fruit.

987. HARLEY, C. P., AND MASURE, M. P. 581.02 : 634.11 : 581.145.2
Relation of atmospheric conditions to enlargement rate and periodicity of Winesap apples.
J. agric. Res., 1938, **57** : 109-24, bibl. 21.

A continuous record of the growth of Winesap apples on the tree was obtained by means of a special apparatus which is described here. Reduction in enlargement rate was found to be closely associated with comparatively high evaporating power of the air and air movement appeared to be the dominant factor in increasing this power. The effect of high temperatures in retarding growth may be exerted indirectly by increasing the evaporating power of the air. There was some indication that temperatures below 50° F. directly limited fruit growth. There was a pronounced daily periodicity in the time and rate of fruit enlargement and it seemed to be influenced by the evaporating power of the air. The daily growth curve was not constant. From 20 July to 16 August the highest rate of enlargement occurred between 10 p.m. and 4 a.m., from 16 August to 13 September it was between 2 and 8 a.m., while between 14 September and 11 October it was between 8 a.m. and 1 p.m. The average daily growth for these periods was 1.89, 1.66 and 1.16 c.c. respectively. The least fluctuation in daily growth rate was found in the minimum growth range between 4 and 6 p.m. Daily fruit measurements taken at this time will, therefore, be less affected by both diurnal and seasonal periodic variations in growth than at any other time in the 24 hours. [From authors' summary.]

988. BLINOV, L. F. 634.11-1.55
Annual bearing of apple trees. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 6, pp. 66-9.

Records taken from 1931 onwards at the Saburovsky State Farm (Tambov District) show that two plots containing Anisovka and Anise varieties bear particularly high average yields of apples. This would appear to be due to the fact that the greater part of the trees from these plots bear annually, and this itself is brought about by a rotation in cropping of the different parts of the trees. The author notes but does not describe devices whereby annual bearing may be thus induced.

Manuring and cultural practice.

989. OINOUE, Y. 631.8 : 634.8 + 634.25
Modification of quantity and quality of grape and peach by changing the order of time of application of N, P and K. [Japanese, English summary 11 lines.]
 Reprinted from *J. hort. Ass., Japan*, 1936, 7 : 12-8, bibl. 4.

The change in order of time of application of N, P and K nutrients was found to result in both quantitative and qualitative changes of peaches and grapes. Liebig's law was applicable only within a limit, and only when the order of time of application of the same nutrients and in the same quantities remained unchanged. A ratio of nutrients therefore may sometimes be favourable and sometimes harmful. It is favourable only when it adapts itself to the nutrio-periodism which was discovered by the author some time ago. Thus, vegetative organs demand much nitrogen, generative organs much phosphate, while for ripening only potash is favourable. Nitrogen applied at the time of ripening counteracts normal development and as a result of this the yield of fruits is smaller and their quality is poorer.

990. KOSTYK, P. P. 634.11-1.55
Increasing the yields of apple trees. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 6, pp. 69-72.

This is a summary from results of field trials with apples in Kursk District, U.S.S.R., mainly dealing with soil preparation, fertilizers, pruning and thinning and their effect on yields. Some varieties would appear to be more prone to annual bearing than others. Mitchurin's theory, that the ability of a variety to produce fruits on one-year-old spurs should be regarded as a sign that the variety is an annual cropper, has been found correct for a number of apple varieties in this district.

991. LARSON, C. A. 631.67 : 634.11
The significance of frequencies and the amounts of irrigation water applied to orchards. (A) As related to soil moisture.
Proc. 33rd annu. Meet. Wash. St. hort. Ass. 1937, 1938, pp. 97-103.

The results of the author's work in apple orchards indicate that before determining the amount and time of irrigation the depth of the root zone and the water-holding capacity of the soil must be considered. Thus soil consisting of 2 feet of fine sandy loam over gravel needs frequent irrigation. On a heavy clay soil or loam the capacity for holding the water is greater, but the penetration of the water is slower and a longer time is needed to fill the root zone with water. The frequency of application should be based on the water-holding capacity of the soil.

992. CLORE, W. J. 631.67 : 634.11
The significance of frequencies and the amounts of irrigation water applied to orchards. (B) As related to tree and fruit responses.
Proc. 33rd annu. Meet. Wash. St. hort. Ass. 1937, 1938, pp. 105-10, bibl. 3.

In nearly all cases in apple orchards under observation terminal growth, leaf area and trunk circumference measurements show correspondingly larger amounts of growth where the water given was increased. Seven year averages show that on a fine sandy loam apple trees receiving water at 30 day intervals produced more fruit than those receiving the same (total) amount of water but at 15 day intervals. There was little difference in size of fruit from trees receiving 40 or more total net acre inches of water per season. Irrigations of only 30 inches resulted, however, in smaller fruit. Lucerne was found useful in these experiments as aiding water penetration, stimulating tree growth and correcting little-leaf symptoms.

993. ANON. 634.1/2-2.111
Special methods of training fruit trees. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 8-9, pp. 60-1.

A special method of training fruit trees for growth under severe west Siberian climatic conditions, worked out by Kisyurin* is described here in some detail. It is stated that this method proved entirely successful on a 10 ha. orchard laid out by Kisyurin for the Omsk Agricultural Institute, where fine large-fruited varieties are grown commercially. The method consists essentially in planting the trees at an angle of 40-45°, the tops facing south and being bent into an almost horizontal position by means of hooks.

994. MARQUES DE ALMEIDA, C. R. 581.148.4 : 634.1/2
Cicatrização des feridas dos vegetais. (Healing of plant wounds.)
Reprinted from *An. Inst. sup. Agron. Lisboa, 1937, 8 : 91-147.*

The healing of wounds in certain fruits trees was studied both macro- and microscopically and the following conclusions were drawn : The best time for the quick healing of pruning wounds seems to be just prior to the beginning of sap rise in the spring. The precautions taken to protect wound surfaces result in a less rapid callusing. In apples the use of wound paints delayed callus formation. In some fruits the cortical tissue is often burnt by wound preparations and in stone fruit the tendency to gum is greatly increased. The author considers their use to be unnecessary and even harmful since in various ways they adversely affect the natural defences of the plants.

SMALL FRUITS, VINES, NUTS.†

995. KASHICHKINA, M. I. 634.711
Preliminary results of the studies of raspberry varieties. [Russian, English summary 17 lines.]
Sci. Fruitgrowing, Mitchurinsk, 1938, No. 1, pp. 31-8.

Over one hundred Russian, as well as European and American raspberry varieties have been collected and studied for 3 years at the Experimental Farm of the Mitchurin Research Institute of Fruit Production. The main objects of the study were phenology, hardiness, productivity and quality of fruit. As a result of the study Kuzmin's New (Russian variety) is recommended for introduction to the North Eastern Zones of U.S.S.R. (Siberia), Viking (American variety) for the Southern and Central U.S.S.R., Lloyd George for the Southern U.S.S.R., and King (American variety) and Volzhanka (Russian variety) for the Central Zone of U.S.S.R.

996. TYDEMAN, H. M. 634.723-1.523
Some results of experiments in breeding black currants. Part II. First crosses between the main varieties.
J. Pomol., 1938, 16 : 224-50, bibl. 6.

The first part of this paper appeared 8 years ago in *J. Pomol.*, 1930, 8 : 106. In the present paper observations for 7 years on twenty families of crosses between the main varieties of black currant are recorded. Inheritance of the following characters is dealt with:—Leaves, vigour and season of leafing, flowers, racemes, fruit and cropping. The ideal black currant is not found in any known variety. The inheritance of such characters as season of leafing, shape of buds and length of flowering racemes follows simple Mendelian laws. In the work in progress it is suggested that larger families from first crosses between certain varieties and crosses between the most promising seedlings are likely to give the best results. Some seedlings from a black currant × a Chinese species, *Ribes longiracemosum*, are described. Treatment of seeds, ovules and pollen with X-rays to induce mutations has so far been unsuccessful.

* See also H.A., 8 : 404.

† See also 989, 1139.

997. WALLACE, T. 631.8 : 634.723
A field experiment on the manuring of black currants.
J. Pomol., 1938, 16 : 127-47, bibl. 2.

An account is given of black currant (var. Baldwin) manurial trials at Long Ashton over the period 1927-37, the treatments being nil, farmyard manure, complete artificials and complete artificials less N, less P and less K, given in triplicate and distributed in randomized blocks. On this soil, a light sandy loam, potash was found to be the primary deficiency, though later both N and P deficiencies were found to limit growth. Potash deficiency appeared to decrease and N or P deficiency to increase susceptibility to leaf spot fungus, *Pseudopeziza Ribis*, which occurred every year and significantly affected defoliation and cropping. Only farmyard manuring increased pruning weights significantly and this was only in the later years of the trial. Farmyard manure and complete artificials both significantly increased yields and the common practice of using the former would appear to be justified. Berry quality was poor when potash was deficient. Nil, farmyard manure and complete artificials caused decreases in moisture of air-dried soil samples, in loss on ignition and total nitrogen in surface soils and subsoils. Available potash and phosphoric acid were increased in surface soils by farmyard manure and by complete artificials but the increases in the subsoils were very small, suggesting fixation in the surface soils. Farmyard manure resulted in higher amounts of phosphoric acid and lower amounts of potash in the surface soils than did complete artificials. Carbonate of lime content was not appreciably affected by treatments.

998. PRUSS, A. G. 634.741-1.541.11 : 634.13 + 634.11
The June berry as initial material for plant breeding and the methods of its hybridization. [Russian, English summary 2 pp.]
Bull. appl. Bot. Leningr., 1936, Ser. VIII, No. 5, pp. 53-102, bibl. 120.

The author summarizes his investigations on the June berry (*Amelanchier* spp.) in the U.S.S.R. Its fruits which are rich in vitamins A and C are useful as a source of wine, jellies, sweetmeats, etc. Some varieties, e.g. *A. ovalis*, combine frost hardiness with good quality of fruit. Others are particularly noticeable for good fruit quality and for yield, e.g. *A. canadensis*. It is suggested that by breeding and selection varieties or strains might well be found suitable for ornamental planting, for fruit production and for use as rootstocks for pears and probably apples in the northern regions of the U.S.S.R., viz. the Leningrad, Kalinin, and Moscow regions.

999. WALLACE, T., AND VAIDYA, V. G. 634.75-1.8
A field experiment on the manuring of strawberries.
J. Pomol., 1938, 16 : 148-66, bibl. 9.

The authors give an account of strawberry manurial trials conducted from 1924 till the present time at Long Ashton. The same manurial scheme was adopted as in the Botley trials which ran contemporaneously. Results at both places as regards effect of manures were very similar and show that the failure in strawberries especially noticeable since the war cannot be attributed to defects in manuring, but rather to certain pests and diseases whose incidence is not affected by manurial practice. The following notes are taken from the authors' summary. The experiment consisted of 5 plantings. The treatment included 3 dung treatments, complete organic manuring containing shoddy and dried blood respectively as sources of nitrogen, organic manuring without potash, a complete artificial fertilizer and no manuring. Dung, shoddy and complete artificials produced relatively luxuriant foliage and the greatest vigour, dried blood with and without potash gave relatively poor vigour. Red plant, yellow edge and tarsonemid mite strongly effected vigour and each of the two latter caused the complete failure of a planting irrespective of manurial treatment. Casualties were sometimes heavy and were attributed to poor quality runners, frost following planting, wet soil conditions, especially in winter, and the above diseases and pest. All treatment except those containing dried blood increased yields. Manuring did not affect the ripening season or the proportions of marketable fruits in the total crops. Mustard crops grown at the end of a three-year planting period suggested low availability of nitrogen at that time from dung and shoddy dressing applied 3 seasons before.

1000. HAMPSHIRE C.C. AGRIC. EDUC. CTTEE. (GLEED, C. J., EDITOR) 634.75
Botley Experimental Fruit Station. Report on experiments on strawberries 1923-37, pp. 66, 6d.

Investigations at the Botley Station in Hampshire, England, are here discussed under the following headings: *Variety and strains* and *Notes on commercial varieties at Botley*. Notes are given of the growth and value of some 14 strains grown commercially or now showing promise. *Effect of planting date*. Planting Royal Sovereign in August was found to give better results throughout the whole life of the plant than planting in September, October or February. *Manurial experiment 1923-37*. Growth and yield were poor throughout the experiment, presumably as the result of unfavourable weather and pathological factors. The general results of the manurial treatments were similar to those obtained in almost identical experiments carried out at Long Ashton for which see abstract 999. *Green manuring*. Green manures ploughed in in early April and consisting either of crimson clover (*Trifolium incarnatum*), sown in August, or of winter vetches sown in September, followed in each case by a dressing of complete minerals in April, gave considerable increase in crop of three strawberry varieties over the controls. *Pest and disease investigations*. Notes are given of the incidence and control measures adopted against the following pests:—blossom weevil (*Anthonomus rubi* Hb.), greenfly or aphid (*Capitophorus fragariae* Theo.), mite (*Tarsonemus pallidus* Banks), eelworm (*Aphelenchoides fragariae* Ritz. Bos.), root weevils (*Otiorrhynchus sulcatus* F. and others), and various ground beetles belonging to the *Carabidae*. Other pests and virus diseases are discussed more briefly, and a description is given of the hot water treatment for pest control. Finally notes are given on the incidence of strawberry failure associated with soil wetness.

1001. BAIN, H. F. 634.76 : 581.144.2 : 582.8
Production of synthetic mycorrhiza in the cultivated cranberry.
J. agric. Res., 1937, **55** : 811-35, bibl. 37.

After a five page review of the literature on cranberry mycorrhizas the author describes his isolation of mycorrhizal fungi from hyphal complex cells in roots of 4 ericaceous species, *Vaccinium macrocarpon*, *V. canadense*, *Chamaedaphne calyculata*, and *Ledum groenlandicum*. They were all specifically distinct from each other and from *Phoma radialis*. All produced the mycorrhizal hyphal complex form in cranberry seedlings growing in sterilized agar. Their effects on growth and on root formation in particular are discussed.

1002. GREGORY, J. H. 634.75-1.564
Marketing strawberries.
Qd agric. J., 1937, **48** : 326-39.

The author is chiefly concerned with the picking and packing of strawberries for market, and several clear illustrations show the best methods of packing boxes and trays. The use in the field of a special picking tray is advocated. Such a tray is fitted with 2 compartments, so that the berries can be graded in the field and thus saved one extra handling. Notes are also given on packing house hygiene.

1003. SECRÉTAIN, CH. 638.22
Comment réussir un élevage de vers à soie. (How to run a successful silkworm farm.)
Progr. agric. vitic., 1938, **109** : 233-6, 258-60, 280-2.

In this article the director of the sericultural research station of Alès gives a detailed account of the entire life of a silk worm as it should be arranged on a successful silk farm. He deals with every aspect of the care of the insects but he scarcely mentions mulberry trees or their cultivation.

1004. WEETMAN, L. M. 635.615 : 575
Inheritance and correlation of shape, size and color in the watermelon,
Citrullus vulgaris Schrad.

Res. Bull. Ia agric. Exp. Sta., 228, 1937, pp. 256, bibl. 25.

The inheritance of a number of characters in water melons has been studied for some time at the Iowa Agricultural Experiment Station. Conclusions are here drawn from the observations made with regard to inheritance of colour, shape and size.

1005. JAMISON, F. S. 635.615 : 631.8
The influence of certain fertilizer materials and practices on the yields of water melons.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 678-80.

The number and total weight of water melons in Florida were decreased by using nitrate of soda as a top dressing. The size of individual melons was, however, increased when nitrate of potash was used, and on the balance the total weight produced was greater than on the control plots.

1006. WHITMORE, J. E. A. W. 588.427
Notes on the cultivation of passion fruit in Kenya.
E. Afr. agric. J., 1937, 3 : 183-5.

The paper deals mainly with certain practical details in the commercial cultivation of passion fruit, *Passiflora edulis*, in Kenya. Virgin land sheltered naturally or by artificial windbreaks is to be preferred. Broad base terracing is advocated with the terraces sufficiently strong to allow of ploughing or cultivating right over them. Planting age of seedlings is 4 months ; the nursery beds containing them should be cleared of eelworm. A good planting distance is 10 ft. between the rows and 18 ft. in the row. The minimum number of trellis poles is 150 per acre, their dimensions 8 ft. × 3 in. with strainers of 9 ft. × 8 in. The intermediate posts are put 2 ft. in the ground and the strainers 3 ft. The wire should be sufficiently strong, 8 gauge fencing wire or 10 × 12 oval steel wire being suggested. The first pruning in young plantations should merely consist in nipping off the points of the shoots to encourage main stem growth in 2 or 4 stems. Overpruning and baring the stem of leaves has been proved to be one of the factors leading to a bad outbreak of *Rhizoctonia* root disease. The leader stems bruise easily and are liable to get sharp kinks and therefore should be treated with care. The leaders should be turned over the wire every few inches and not allowed to hang by their tendrils. The leaders should be encouraged to throw down their fruiting spurs vertically every 8 inches or so along the wire. The second pruning should be confined to stopping back the fruiting spurs until the leaders reach the wires. Until the wire is reached the leaders are trained up vertical sticks and tied at every 9 inches as they grow. In 14 months from planting cropping should have begun, and in 21 months the vines should have covered the wires. The soil must be kept well tilled and open, and if a cover crop is grown it must be kept out of the branches at the base of the terraces.

1007. KATZ, J. F. 634.83
The Central Asiatic grape varieties. [Russian, English summary 13 lines.]
Bull. appl. Bot., Leningr., 1936, Ser. VIII, No. 5, pp. 159-204.

For many years ampelographic studies were made by the Institute of Plant Industry in Uzbekistan, Tajikistan and Turkmenistan. Some of the results are given in the present paper,* and may be summed up as follows : There have been established 134 aboriginal grape varieties, which for the sake of more convenient study have been divided into four classes : 1. White varieties ; 2. pink, red and purple varieties ; 3. black varieties ; 4. seedless varieties (three). Classes 1, 2 and 3 have again been arranged into groups embracing varieties showing similarity

* The publication of a full report, consisting of two volumes of " Ampelography of Central Asia " by Popov, M.G. and other authors, is envisaged for a future date.—EDITOR.

in morphological characters. Concise morphological descriptions of the groups and varieties are given, together with notes on their geographical distribution and an estimate of their economic value.

1008. TANAKA, Y. 634.836.72

Investigations on the phylloxera resistant stocks of the grape vine. [Japanese, English summary 4 pp.]

Reprinted from *J. Okitsu hort. Soc.*, 1936, 32: 190-224, bibl. 16.

In the search for vine stocks resistant to phylloxera in humid regions, investigations were carried out in 1923-9 at the Okitsu Imperial Horticultural Experiment Station (Japan) in which 40 varieties of stock plants were used. Morphological and ecological characters of these varieties were thoroughly studied, and actual propagation tests were conducted in the field. Meteorological records taken at the station showed an average yearly temperature of 15.8° C. with 2,200 mm. annual rainfall. Monthly precipitation in April to October averaged more than 200 mm. Under such climatic conditions certain stock plants, the canes and leaves of which are susceptible to fungus disease, cannot be used for practical purposes. As a result of the tests, varieties have been divided into the following groups: (1) Vigorously growing varieties, having high adaptation to humid regions; (2) medium growth varieties having some adaptation to humid regions; (3) weak growers not suited to humid regions. A study of the growth habits of canes and roots (which are closely correlated), permitted a classification of the varieties according to their root characters into: (1) deep rooting varieties; (2) medium rooting varieties; and (3) shallow rooting varieties. In order to determine the value of the vines as stocks their readiness to produce large numbers of cuttings, storage tolerance preceding grafting, rooting power and relative ease of grafting were studied. All these factors were found to be closely connected with the relative thickness of woody tissue, the varieties belonging to *Vitis vulpina* Linn. (*V. riparia*), on the whole having thicker woody tissue and showing lower reproductive power than other varieties. Trials in which a Black Hamburg scion was grafted to 17 different stocks, are discussed in some detail. As a result of these trials seven rootstock varieties are recommended as stocks for Black Hamburg and similar commercial scion varieties in humid regions.

1009. CAPUCCI, C. 634.8-1.535

Influenza dell'età della pianta, della potatura della radice e dell'innesto sullo sviluppo della vite nel primo anno di vita a dimora. (Influence of age, root pruning and grafting on the growth of a vine in its first year in permanent quarters.) [English summary.]

Riv. Frutticoltura, 1938, 2: 153-78, bibl. 27.

The rootstock used in the trials here described was in all cases Teleky 5 BB and the scion Albana. The author reached the following conclusions: (1) Both in grafted and ungrafted vines the greatest growth was shown in the first year after planting out by 2-year-old cuttings. (2) The 2-year grafted plants did not do so well as the ungrafted. (3) The increase in growth both in 1-year-old and 2-year-old cuttings was proportional to the amount of roots left on the plant. Smaller increases were made following root pruning. (4) The cuttings on which the largest quantity of roots was left made the best growth. The 2-year-old cuttings were the most sensitive to root pruning, and of them the grafted ones were most affected by it. (5) Grafted cuttings when planted showed very inferior growth in the first year to ungrafted cuttings planted out. (6) Grafted cuttings grew less satisfactorily than ungrafted cuttings. (7) In January and February the root system both in grafted and ungrafted plants is richer in carbohydrates than the aerial portion of it, but in May the opposite is the case. (8) It is probable that the callus formation in grafted plants obstructs the free circulation of the elaborated lymph and so deprives the root system of food, which results in less vegetative growth in the first year. (9) The smaller growth increase of grafted vines can also, in the author's opinion, be attributed to the attacks of *Peronospora* which are very liable to occur on the aerial parts of cuttings in the propagation bed and to the different composition of the American and European vines,

which entails either impoverishment or increase in reserve due to the scion. (10) In 2-year-old cuttings the callus still seems to obstruct the free circulation of nutrients but to a much smaller extent, and as a result the root system is richer in carbohydrates than that of the 1-year plants. A probable reason for young rooted cuttings making better initial growth than older ones is that they are, on uprooting preparatory to transplanting, deprived of a smaller proportion of their roots than the older ones.

1010. LAGATU, H., AND MAUME, L. 634.8-1.8
Mesures de biochimie agricole sur les rameaux de la vigne. (**The application of biochemistry to solve the problem of vine nutrition.**)
Ann. Éc. Agric. Montpellier, 1938, 25 : 137-73.

The difficulty of choosing the proper manuring for particular vines can be largely overcome given a knowledge of the method of nutrition of the vine in question. This can be determined by a biochemical examination of the leaves.

1011. LAGATU, H., AND MAUME, L. 634.8-1.8
Dans quelle mesure les variations atmosphériques peuvent-elles, sous le climat méditerranéen, modifier chez une vigne les rapports physiologiques et les quantités absorbées d'azote, d'acide phosphorique et de potasse? (**To what degree can atmospheric variations modify both total amounts and relative amounts of N, P and K absorbed by a vine under Mediterranean climatic conditions?**)
Ann. Éc. Agric. Montpellier, 1936, 24 : 159-79.

Observations have been made by leaf analysis of the amounts of N, P and K absorbed by vines, actually Aramon on Rupestris, at 6 different dates each year in the years 1923 to 1928, under the same conditions of soil and manure. The total amount as also the relative amounts, i.e. the N:P:K ratio, has varied greatly from year to year according to atmospheric variations. The authors note that the same phenomenon has been observed in work on potato and barley. The deductions applicable to vine manuring in the Mediterranean are as follows:—The application of a balanced manure containing fairly high quantities of N, P and K does not result in the vine absorbing these substances in the same proportions as offered. The vine both in manured and unmanured soil can make a choice both of amount and relative proportions of such elements. For a given vine in a given soil, this choice, which may change considerably from one year to another, depends essentially on the prevailing atmospheric conditions. NPK nutrition is not the exclusive result of what the soil or fertilizer has to offer. Observations for 6 years at Grammont did not show any effect on the accumulation of nutrients resulting from application of 80 kg. N, i.e. 40 dried blood, 20 powdered horn, 20 nitrate of potash, 75 kg. P_2O_5 , i.e. mineral superphosphate, and 90 kg. K, i.e. 66 nitrate of potash, 24 sulphate of potash.

1012. LAGATU, H., AND MAUME, L. 634.8-1.8
Sur la sensibilité du diagnostic foliaire pour déceler une absorption d'engrais par la vigne. (**The sensitive reaction of leaf diagnostic for disclosing the absorption of fertilizer by the vine.**)
C.R. Acad. Agric. Fr., 1938, 24 : 615-24.

The authors recount an experiment in which it was found possible to detect by means of leaf diagnostic the effects of different manurial treatments on Aramon vines grafted on 1202 when neither the crop nor the appearance of the vines gave any clue to these effects. After showing graphically and discussing the disclosures made by the leaf diagnostic they conclude as follows:—Leaf diagnostic has given us the following information:—(a) The measured amount of fertilizer given in 1928 was insufficient to have any good or bad effect; (b) the leaves examined have shown us that any possible influence would have been favourable as regards potash and unfavourable as regards nitrogen and phosphorus; (c) each of the three fertilizing principles has actually, thanks to slight absorption, modified the NPK nutrition of the vine in this direction, the potash supplied bringing it near to the optimum and the nitrogen and phosphorus keeping it away

from the optimum ; (d) the action of nitrogen has been positive and similar whether sulphate of ammonia, ammonium chloride or cyanamide was the source ; (e) the two sampling points distant about 40 m. from each other in the vineyard have shown very slight systematic differences in the course of the NPK nutrition of the vine, showing that the practical homogeneity of a soil does not prevent a slight heterogeneity which is disclosed by leaf diagnostic. Briefly, though neither the appearance of the vineyard nor the crop could tell us anything, leaf diagnostic has given us plenty of information on the effect of the late application of fertilizers in 1928. The biochemical examination of the leaf of the vine can therefore prove an able guide to the manurial requirements of a given vine.

1013. VAN HAARLEM, J. R., AND UPSHALL, W. H. 634.8-1.542+1.8

Pruning and fertilization experiments with Concord grapes.

Sci. Agric., 1938, 18 : 485-99, bibl. 12.

The authors discuss the observations made by them in the process of manurial and pruning experiments on the *Labrusca* grape vine, variety Concord, in the Niagara district of Ontario. Vines were pruned so as to leave 30, 36-42 or 42-54 buds and the manuring included artificial fertilizers, the application of straw and lime and green manuring. Overpruning caused crop reduction, though there was some compensation in larger bunches and berries. Extreme overpruning resulted in lower sugar and higher acid in the juice. Underpruning gave small bunches and small berries and weakened the vines. No fertilizer appreciably affected the sugar and acid content of the grape juice. Soil analyses showed, however, that a large part of the phosphate and potash applied remained in the top 6 inches of the soil, i.e. above the root zone. Nitrate of soda alone did not increase growth or fruitfulness and in fact actually slightly depressed both. Increases in yield from the different combinations were very small, a NPK combination giving the greatest. The addition of straw and green manures without phosphate and potash gave marked increases in growth and fruit production.

1014. CAPUCCI, C. 634.8-1.542

Sulla fertilità delle sottogemme di alcuni vitigni coltivati nelle colline dell'Imolese e del Bolognese. (**The fruitfulness of secondary shoots in some vines grown on the hills near Imola and Bologna.**) [English summary.]

Riv. Frutticoltura, 1938, 2 : 89-99, bibl. 6.

Observations in 1936 and 1937 show that the direct producer, Jacques, produced a greater number of secondary shoots than any other vine examined. In descending order of production came a number of other vines, but others such as Sangiovese, Albana, Chasselas and Sauvignon varied as to their capacity for producing fruitful secondary shoots not only among themselves but also according to the season and to the time of pruning. In two vines, examined only in 1937, no secondary shoots were made. The best pruning time so as to obtain a certain number of fruitful secondary shoots should not be later than April. In the author's opinion this is due to the fact that the fruit-bearing arm is at the beginning of growth still rich in nutritive substances and is, therefore, capable of nourishing the secondary shoots and allowing the bunches of grapes, if they are actually there, to develop, whereas in May the nutrient substances stored in the wood of the fruit-bearing arm will all be exhausted, with the result that the secondary shoot, as the result of the removal by pruning of the principal shoot, grows stuntedly and any grapes formed are starved.

1015. LAGATU, H., AND MAUME, L. 631.821 : 634.8

Vigne et apports calciques. (**The application of lime to vines.**)

Progr. agric. vitic., 1938, 109 : 569-73, 593-7, and 110 : 9-15.

There is considerable disagreement as to the advisability of adding lime to vineyards in non-calcareous soils. The authors have investigated the effect on the general nutrition of the vine of adding lime to such soils and they come to the conclusion that under the conditions obtaining at Grammont the addition of lime is a matter of indifference or even may be harmful. They show a number of their nutritional data graphically.

1016. MANARESI, A. 634.8-1.546
 Notizie storiche e culturali sugli alberi usati sino dall'antichità in Italia come tutori per le viti. (**Historical and cultural notes on trees used in Italy as supports for vines.**)

Reprinted from *Ann. Soc. agrar. Bologna*, 1936, Vol. 64, pp. 91, bibl. 88.

In this account of that most common feature of the north Italian countryside, i.e. vines trained on living supports, the author has most evidently accomplished a labour of love. Prefacing his story with a brief note on investigations by Branzanti, Dotti and others which clearly show that the growth of vines under such conditions is restricted by inevitable root competition, he then regales us with the opinions of experts through the ages, starting with Cato in *De re rustica* and proceeding with the help of Virgil and Pliny down to Dalmasso and Poggi of the present day. The custom has been almost entirely confined to Italy, though a few instances are recorded from Greece. It is still prevalent and arguments as to its desirability and the respective merits of different supports are still banded to and fro between wine-growers and professors. At any rate, if anyone does want to try the practice outside Italy, he is here afforded an excellent opportunity of studying the possible benefits claimed for the use of particular types of tree. The following trees have been and generally are still used to some extent for the purpose:—four varieties of maple (*Acer campestre* L. and others), four varieties of elm (*Ulmus* spp.), four varieties of poplar (*Populus* spp.), willow (*Salix alba*), two varieties of ash (*Fraxinus* spp.), oak (*Quercus Robur*), *Robinia Pseudacacia*, *Celtis australis*, mulberry (*Morus alba*), walnut (*Juglans regia*), cherry (*Prunus Avium*), pear, apple, plum, almond and apricot. Some seventeen other types of tree are also mentioned more briefly as having been used, though less frequently. Recent investigations show that with regard to the trees most commonly used the growth of the vine is least restricted when grown in association with the maple, that the elm comes second and is followed by the poplar. There are of course local preferences. Good illustrations are given showing the different supports in the vineyard.

1017. GERVAIS, P. 634.835.094
 Les vins d'hybrides producteurs directs. (**The wines produced by direct producers.**)
C. R. Acad. Agric. Fr., 1938, 24 : 492-5.

Grapes from a large number of direct producers were made into wine by the Station Agronomique et Oenologique de Blois. A number of the direct producers gave very poor quality wines and might well be eliminated. Others on the contrary produced wines that in chemical composition were absolutely comparable with those produced by the native proved varieties of vine and as regards flavour and other such qualities were considered by the experts to be perfectly satisfactory for everyday use.

1018. CLAROU, C. 631.3.083/084 : 634.8
 Essais de tracteurs vigneron. (**Trials of vine tractors.**)
Ann. Éc. Agric. Montpellier, 1938, 25 : 37-41.
 BRANAS, J., BERNON, G., AND LEVADOUX, L. 634.8
 Sur le déterminisme rationnel de la qualité des produits de la vigne. (**The factors affecting quality of product in the vine.**)
Ann. Éc. Agric. Montpellier, 1938, 25 : 103-22, bibl. 9.
 VENTRE, J. 663.252.4
 Acidité volatile et fermentation. (**Volatile acidity and fermentation.**)
Ann. Éc. Agric. Montpellier, 1938, 25 : 15-35.

1019. PRESCOTT, E. E. 634.51
 Nut culture in Victoria.
J. Dep. Agric. Vict., Aust., 1938, 36 : 68-75, 333-8, bibl. 1.

The normal method of cultivating walnuts is described. There is some discussion on the most suitable varieties and the nuts of the best of these are illustrated. Suitable rootstocks have proved to be *Juglans californica* and its variety *Hindsii*, the northern California form, *Juglans*

Sieboldiana, the Japanese walnut, and two hybrids, Paradox and Royal. The best method of topworking old trees is to cut them back and bark graft them in early spring, a few growing branches being left as lungs and removed later in the year. Scions so applied make very vigorous growth. Methods of budding or grafting year-old nursery stock are barely mentioned as being too uncertain in results for the amateur. As planting distance is very wide, 35-45 feet apart, the ground between may be utilized for the first eight years by growing filler fruit crops. Annual fruit or vegetable crops requiring manure are suggested as taking less out of the soil than tree fruits. Pruning grown trees should aim at supplying plenty of new shoots on which the fruits are borne. It may not be necessary annually. Certain varieties, of which Eureka is one, bear many nuts inside the leaf canopy and therefore require maintenance of an open centre. Pruning should be done in the winter as late pruning when the sap is moving results in bleeding.

1020. Roy, H. 634.51

La culture du noyer dans l'Isère.* (*Growing walnuts in Isère.*)

Progr. agric. vitic., 1938, 109: 420-4, 441-5, 462-5, 482-5, 546-8, 566-8.

These few pages give an interesting account of the salient features of walnut growing in that small district around Grenoble in the South of France which is famous for its walnuts throughout the world. In the valley of the Isère the walnut occupies situations which differ greatly as regards soil and climatic conditions and appears to thrive adequately in all of them. Figures of a census taken in 1929 show that there are in the Department of the Isère some 2,247 hectares under walnuts and that the production of nuts amounts to more than 60,000 quintals (i.e. nearly 6,000 tons) a year, 75% of these being sold. Descriptions are given of the following varieties:—Mayette, Franquette, Parisienne, Chaberte, Billarde, La Culeronne, Souvenir de Congrès, Noix de Vourey, Noix Meylanaise, and Bijou. Many of these have merely a local popularity and only the first three can really claim the name of Grenoble walnut. They form the majority of the trees planted. The trees are grafted, using either cleft grafting in April when the sap is not very abundant or crown grafting rather later with 3 or 4 scions, both of these operations taking place in the open. Grafting on the root collar under glass results in good unions but is not recommended apparently in view of the premature fruiting which often occurs and is followed by abnormal growth. Generally speaking success of grafting at ground level may be put at 25 to 35%, and in crown grafting at 70-80%, but atmospheric conditions appear to have an enormous influence on the take. 50% will be considered an average good take. The importance attached to grafting is shown by the fact that courses in grafting are given at the local centres of walnut growing and are well attended. *Rootstocks.* *Juglans regia* is most commonly used, but by some experts *Juglans nigra* is preferred as being resistant to a root rot known as "Maladie du pus" and attributed by some to *Armillaria mellea*. *J. nigra* does not take the graft quite so readily as *J. regia* but later makes magnificent trees, which incidentally come into bearing 4 or 5 years earlier than those on *J. regia*. Other stocks used with varying success are Hybride guillot and *Juglans Sieboldii*. The author considers that for dry superficial soils *J. regia* is best, but that given a deep rich soil *J. nigra* hastens fruiting and increases cropping, the fruit also being larger and heavier. *J. nigra* is, moreover, less susceptible to the maladie du pus. The trees which begin to crop in their 5th year if on *J. nigra* and in their 10th year on *J. regia* are planted about 80 to the hectare (32 to the acre). They are manured each year, a sample amount being per tree:—superphosphate or slag 6 kg., cyanamide or sulphate of ammonia 2 kg., chloride or better sulphate of potash 2 kg. The ground is ploughed up annually and is scarified 5 or 6 times during the summer. After harvest the nuts are dealt with in various ways often by co-operative methods, a large number being sent abroad even as far as America.

1021. KOLESNIKOV, V. A. 634.51

Walnuts in Crimea. [Russian, English summary 12 lines.]

Soviet Subtropics, 1938, No. 7 (47), pp. 72-6.

This is a tabulated account of the studies on walnuts which have been carried out since 1935 by the Crimean Agricultural Institute. In the course of the study some 24,000 walnut trees

* For a fuller account of walnut growing in this district see by same author *Le Congrès de la Noix de Grenoble*, 10-11 Oct., 1936, Co-operative agricole de Grenoble, pp.187.

have been examined. The following conclusions are reached: The average weight of kernels of the Crimean walnuts amounts to 47.8% of the total weight, whereas that of the French walnuts is only 43.7%, and that of walnuts from other parts of U.S.S.R. even less. The fat content in Crimean walnuts (55.1-75.0%) is considerably higher than that in French walnuts (55.5-61.7%). Albumin content of the former is also very high. The yields obtained from Crimean walnut trees often exceed 100-200 kg., even though the trees in most cases do not receive any cultural treatment.

1022. DOROFEEV, P. P. 634.51
***Juglans regia* L., var. *racemosa* Duh in Moldavia.** [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1938, No. 2-3, pp. 137-8.

During one of the botanical expeditions conducted by the Moldavian agricultural institute 150 samples of walnuts were collected. The plant material found is now under investigation and a full report will be given later in this journal. This article deals solely with *Juglans regia* L. var. *racemosa* Duh. Two types of this walnut, differing in the shape of the leaf and shape and size of the nut have been established. A detailed description of both plants and fruits is given. This walnut is considered as valuable material for hybridization work.

1023. BUSH, C. D. 634.51-1.541
Grafting Oregon's biggest seedling walnuts.
Bett. Fruit, 1937, 31 : 12 : 8, 13.

An account is given of the topworking of 30-year-old seedling walnuts to Franquette. The trees so treated require six years to return to full production. Although the usual way is to cleft graft on the cut back branches a new technique has been evolved in which the graft is merely nailed on without cutting into the limb. The method is said to be more successful in number of takes and is much quicker.

1024. KOIDZUMI, G. 634.51 + 586.28
On the classification of the *Juglandaceæ*. [Japanese and Latin.]
Acta phytotaxonom., Kyoto, 1937, 6 : 1-17. Abstracted in English (12 lines) in
Jap. J. Bot., 1938, Vol. 9, No. 2, abstr. 193.

1025. ROBINSON, W. O., WHETSTONE, R., AND SCRIBNER, B. F. 634.521 : 581.192
The presence of rare earths in hickory leaves.
Science, 1938, 87 : 470.

A brief account is given of some 11 rare earths found spectroscopically in the leaves of hickory. The presence of moderate lines of europium, one of the rarest of the rare earths, is considered interesting and may point to a concentration of this element by hickory leaves.

1026. CHIKHLADZE, V. T., AND LOBKO, T. G. 634.55
Almond cultivation in the valley of Nizhni-Kothernigan. [Russian, English summary 8 lines.]
Soviet Subtropics, 1938, No. 6 (46), pp. 75-81.

This is a preliminary report of the studies conducted by the authors in 1937 on some 50 almond forms growing in the Nizhni-Kothernigan valley (Tajikistan). Detailed descriptions are given of 15 cultivated varieties.

1027. RUGGIERI, G. 634.55 : 582.8 : 581.144.2
Sopra le micorize del mandorlo. (Almond mycorrhizas.)
Boll. Staz. Pat. veg. Roma, 1937, 17 : 165-8.

The author established the presence of an endophytic mycelium of a mycorrhizal type in the primary bark of sectioned roots of almonds growing in Sicily in the province of Syracuse. He describes it with the aid of two microphotographs.

1028. BRYDEN, J. D. 634.55-1.542
Pruning the mature almond tree.
Agric. Gaz. N.S.W., 1938, 49 : 264-5, 288.

It is very necessary, in order to obtain the fullest yield with the almond, that the tree centre should be kept open to allow the penetration of light. The almond bears on yearling laterals and on spurs produced on older wood. The number of laterals allowed to remain should be regulated according to the condition of the tree with the object of supplying necessary renewals. The yearling laterals should be left at full length for fruiting and subsequently shortened to assist the development of spurs, the degree of shortening to increase in severity in proportion as the tree lacks vigour. Spurs only last a few seasons and their continued renewal will be provided by the cutting back of the laterals. After the tree is 5 years' old it need not be leader-pruned unless the leaders eventually become too thick on the crown, when the surplus may be cut off at their point of junction with the secondary limb. Old trees required to be re-established should not be heavily de-headed as is often advocated. It is best accomplished by the removal of about one-third of the number of secondary limbs and heavily pruning the small growth. The top growth should be severely thinned and pruned back to secondary limbs in suitable positions at about a quarter to a third of the distance from the top of the tree. As new growth is produced more secondary limbs can be replaced.

1029. BRYDEN, J. D. 634.55
Handling the almond crop.
J. Agric. N.S.W., 1938, 49 : 212-4.

Prompt harvesting of almonds as soon as the hulls are fully open ensures the production of bright clean nuts and facilitates hulling. Hulling should be done just after harvesting when the hulls are green and soft. If the hulls have become dry the almonds should be sprinkled with water. After a very dry year the hulls may stick to the shells after drying. Such almonds cannot be hulled at all and should be disposed of for shelling. Almonds must be thoroughly sun dried before bagging and the right condition is indicated when the kernels can be broken without bending. Quick drying is necessary or the shells may darken. To ensure the bright clean shell demanded by the trade the nuts can be fumigated on trays by burning flowers of sulphur in an air-tight chamber at the rate of 1 lb. of sulphur to 300 cubic feet of air space. Varieties sold for shelling and those having a tendency to crack along the wing should not be sulphured. Storage should be in a cool, dry, ventilated space. Too much moisture will cause deterioration or rancidity in the kernels. Grading and classification is not practised but is desirable. A method of grouping is suggested.

PLANT PROTECTION OF DECIDUOUS FRUITS*

1030. MANARESI, A. 634.8-2.13
Rilevazione e stima dei danni della grandine sull'uva. (Detection and assessment of hail damage in vines.)
Extracted from the Proceedings of a Conference held at Bologna in April 1937, and printed by the Tipografia Editrice Sallustiana, Piazza Grazioli 6, Rome, pp. 19, bibl. 13.

After considering the various parts of a vine which can be damaged to a greater or less extent by hail and the actual damage sustained the author deals with the estimation of loss sustained by the vine grower under two heads, namely, loss of crop and indirect damage. 1. *Loss of crop.* It is essential that notice should be taken immediately after the hail storm of the number of grapes or of bunches of grapes detached. Next, once the percentage of actual detachment has been determined, attention must be paid to the damage sustained by the bunches and individual grapes which remain. The percentage of damaged grape stalks should be noted and the percentage of grapes damaged in such a way as to wither or dry up, or having their

* See also 964, 976, 993.

skins broken or becoming brown. At the same time it must be remembered that, if only part of the bunches are damaged, the loss may actually result in the parts which remain bearing bumper crops, a feature which will compensate more in the case of wine grapes than in that of table grapes. 2. *Indirect loss.* Under this heading can be counted the loss sustained in the resulting lack of uniformity in the harvested crop, thus healthy grapes will be mixed with withered grapes, while others will bear scars or will have suffered in quality. The wine made from such mixed samples has a lower alcohol, a higher tannin content, and a higher solids and nitrogen content. In the case of table grapes the damage will necessitate a good deal of additional labour in packing, if it does not indeed make the whole sample unfit for market. The insurance companies in Italy will only pay for loss sustained in the crop of the year in question. Hence the author considers mainly the points on which the grower can base his claim under such conditions. He discusses the tables of percentage losses proposed by certain insurance companies as a general guide to damage sustained. These tables are based on the percentage loss of grapes in each vine and allowance is made for the type of vine whether grown for ordinary or fine wine making or for ordinary or special table grape production.

1031. GESLIN, H. 632.111 : 634.1/7
 Les gélées d'avril 1938 et les arbres fruitiers. (**April frosts of 1938 in the orchard.**)
C.R. Acad. Agric. Fr., 1938, 24 : 692-9.

The author discusses the spring frosts experienced in Northern France in April 1938, the damage done to fruit trees and the possibility of preventing such damage. There were three dates of dangerous frost, namely 4 and 5 April, 9-12 April and 18 and 19 April and an estimate of the loss sustained shows a total loss in almonds, peaches and apricots. Plums were likely to give a very small crop. Pears were largely blackened inside, Beurré d'Hardenpont alone showing a certain number, 20% or a little more, of healthy and complete fruits. In general the following deductions appear to be justified:—for completely shut blossom buds (diameter 3 to 4 mm.) the critical temperature appears to be anything below -6°C . Just before flowering the critical temperature is -4°C . and it drops to -2.5 to -3.0°C . for flowers completely opened and to about -2.5° for fruits on the point of setting. As regards control it is estimated that, if one counts on -3°C . or -2°C . as being the critical temperature, then orchard heaters would have had to be lighted as a precaution on 6 nights in 1933, 5 of them being consecutive, and on 9 nights in 1938, while in the intervening years they would only have been necessary on one or two nights each year at most. For luxury grade fruits, at any rate, the use of charcoal burners is recommended and attention is drawn to the work of M. Lièvre on an estate near Dreux. In 1938 he achieved excellent results by the use of 150 such burners a hectare on 20 hectares of espalier-grown Passe Crassane pears and Calville Blanche apples.

1032. MOSES, B. D. 632.111 : 634.3 + 634.51
Blowers for frost protection.
 Reprinted from *J. Amer. Soc. agric. Engrs.*, 1938, Vol. 19, No. 7, pp. 2.

A brief illustrated account is given of the operation of frost protection blowers as used in California walnut and citrus orchards. An illustration is given of a blower in a walnut orchard. It consists of a large propeller, aeroplane type, 12 ft. in diameter, directly connected with a 425 h.p. engine, mounted on a platform 50 ft. above the ground. The platform is geared to the engine, and rotates about a vertical axis at a speed of about 15 revs. an hour. A further illustration shows a smaller blower driven by a Ford V 8 engine drawing air up through a central column, at the base of which is an oil furnace. There are said to be some 150 of such blowers operated at present in California. The idea behind the system is based on the fact that, when temperature inversion is produced by radiation on cold still nights, the air temperature increases with height from the ground and produces, as it were, a warm ceiling of air. If blowers can be made to stir this warm ceiling, it is thought that warmer conditions may be obtained at tree level. Whether this can be kept up with the process of radiation needs to be determined. Experiments made in orange orchards in 1934/35 indicated the achievement of positive protection by the use of

blowers. In 1937/38 the blowers were combined with the use of furnaces at the base, the attempt being made to blow heated air down on the trees. The heat was provided by a furnace capable of burning 20-40 gallons of oil per hour. Figures of temperatures recorded are given. The author is of the opinion that (1) under conditions of temperature inversions of 10° in 100' elevation air temperature in orchards can be kept 3° higher with a blower mounted on a tower 40-50' above the ground; (2) that blowers of 75 h.p. size will not handle more than 10 acres, except where air drainage is very favourable; and (3) that it may be possible effectively to combine such blowers with orchard heaters.

1033. DAVISON, J. R. 632.111
Orchard heating.
Agric. Gaz. N.S.W., 1938, 49 : 374-7, 455-60.

The article discusses the principles of orchard heating and concludes with an account of heating trials carried out by two growers at Yenda, N.S.W., on vines and apricots. The heaters used seem to have given off a good deal of smoke since the rising sun is spoken of as being so obscured on one occasion by the heavy pall of smoke that its warmth was unable to raise the temperature till the smoke had cleared. A list is given showing the degrees of cold which different fruit trees will tolerate for half an hour in the pink bud, full bloom and small green fruit stages.

1034. MARANI, M., GOIA, G., AND GERBALDI, C. 634.25-2.111
 Osservazioni sulla cascola delle gemme da frutto nel pesco. (**Notes on fruit bud fall in peaches.**) [English summary.]*
Riv. Frutticoltura, 1938, 2 : 73-87.

A further year's observations on premature bud fall in peach recorded from Ravenna (see *Ibidem*, 1 : 89-96, *H.A.*, 7 : 877) show that considerable falls again took place at the end of January and beginning of February 1938. The winter had been cold and the fall would appear to have been due to the great differences in day and night temperature experienced at the end of it. Data from an orchard containing 75 different varieties show a tremendous variation of susceptibility in different varieties, some varieties, e.g. Uneeda, hardly losing any buds at this time (1.02%) and others such as Belle de Cahors nearly all (91.72%).

1035. HOPKINS, J. C. F., AND BACON, A. L. 634.11-2.3/4
Common diseases of apples and their control in Southern Rhodesia.
 Reprinted from *Rhod. agric. J.* as *Bull. Minist. Agric. S. Rhod.*, 1,071, 1938, pp. 15, bibl. 1.

An account is given of the investigations made during 1937-8† into the more common apple diseases in Rhodesia and their control. A new spray schedule and other methods of control are suggested.

1036. MORWOOD, R. B. 634.11-2.19
Little leaf of the apple.
Qd agric J., 1937, 48 : 673-8.

The author describes the symptoms of little leaf or rosette of the apple as seen in the Stanthorpe district. There are indications that although it occurs in a very wide range of varieties and stocks, Delicious is somewhat more subject to it than other varieties and that reworked trees are often the first to be affected in an orchard. Affected trees show a beneficial response to zinc treatment and foliage spray with zinc lime (8 lb. zinc sulphate dissolved in 70 gallons water to which is added 4 lb. hydrated lime dissolved in 4 gallons water while stirring) has given commercial control in one experiment.

* It may be noted that summaries in German, French and English of the chief articles are included in Vol. 2, Nos. 2 and 3 of the *Rivista*. Their continuance in future would make this journal considerably more valuable to the foreign reader.

† See also *Bull. Minist. Agric. S. Rhod.*, 1937, 1,040, pp. 12, bibl. 5, *H.A.*, 8 : 101.

1037. DAVIS, L. D., AND MOORE, N. P. 632.19 : 634.13

Black-end of pears V. Seasonal changes in pH of the fruit.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, **35** : 393-401, bibl. 11.

Fruit from black-end trees seems to be consistently more alkaline than that from normal trees and becomes markedly so just before the rapid increase of black-end fruits. The close relation in point of time between the appearance of black-end and the occurrence of significant differences between the two groups of fruits suggests the occurrence of an intimate association between the two phenomena prior to the time that the disease is visible.

1038. BERNON, G. 634.8-2.19

Recherches sur la coulure. (Research on coulure.)

Ann. Éc. Agric. Montpellier, 1936, **24** : 57-68, bibl. 6.

From observations on the incidence of coulure in the variety Clairette and the results of different treatments the author concludes that the falling off of flowers without further development is, in the case of this variety, due to imperfection of pollen in conjunction with a serious starvation of the bunch. Fruit formation is assured by the use of foreign pollen, ringing and pinching back.

1039. LAFON, J. 632.19 : 546.72

Étude, préparation et emploi d'un sel de fer efficace contre la chlorose.

(Investigation, manufacture and use of an iron salt for controlling chlorosis.)

C.R. Acad. Agric. Fr., 1938, **24** : 790-5.

Figures are given which indicate that the use of a solution of sulphate of iron plus citric acid applied to pruning wounds is even more efficacious in controlling chlorosis than that of ordinary iron sulphate. Consideration is given to the difficulties attending the mixture of the solutions of the two salts and the necessity for storage under special conditions, and the suggestion is made that the best method of procedure will be first to make a concentrated solution of the two components in the proper ratio, then evaporate and dry them, when little agglomerates of iron sulphate crystals, and of crystals of citric acid and sulphate of iron will form. On redissolving this mixture the required product ready for use will be available.

1040. VIDAL, J. L.* 634.1/8 : 581.111 : 632.19

A propos du traitement contre la chlorose calcaire des arbres fruitiers. (The treatment of chlorosis in fruit trees.)†

C.R. Acad. Agric. Fr., 1938, **24** : 159-64, bibl. 4.

The author gives a brief account of various injection experiments made by him at different dates in recent years and reported elsewhere namely, *Ibidem* 1936, **22** : 306, 315, *Progrès agric.* 1936, **106** : 515, *Progrès agric.* 1937, **107**, Nos. 2, 3, 5 and 6, and *C.R. Acad. Sci. Paris*, 1937, **205** : 1092. After noting the various methods adopted by different workers and the conclusions reached by Joessel and Lidoyne, the author gives brief notes on his own work. In one experiment 5 chlorotic vines were cured of chlorosis by inserting a root in each case into a flask filled with a solution of citric acid. In another a chlorotic rose tree was similarly restored to greenness between 17 September and 3 October, 25 centilitres of solution being used. Chlorotic peach trees were successfully treated by root immersion in a solution of the following proportions :—water 1000 g., citric acid 20 g., sulphate of iron 100 mg. The colour began to improve after about 10 days and got progressively better. Experiments to determine the proper amounts of iron sulphate in the case of trellised vines, pears and cherries, are envisaged. Success has been achieved at all stages of the growing season from May to September, and there has been no trouble with gumming. M. Gervais noted the efficacy of Rassiugier's method whereby the cut surfaces of affected vines were treated at pruning with iron sulphate and showed an absence of chlorosis in the spring.

* And Gervais who joined in the discussion.

† For details of injection technique see Roach, W. A. Plant Injection for diagnostic and curative purposes: *Tech. Comm. Imp. Bur. Horticulture*, 10, 1938, pp. 78, 5s.

1041. BRANAS, J., AND BERNON, G. 634.8-2.8
Résumé des recherches entreprises en 1936 sur le traitement de la panachure de la vigne. (Note on investigations on panachure of the vine and its control.)

Ann. Éc. Agric. Montpellier, 1937, 24 : 249-52, bibl. 6.

This yellowing of the foliage of the vine known as panachure differs from chlorosis in that it appears irrespective of whether the soil contains lime or not. It may occur in any variety but it is particularly noticeable in those which show little resistance to court-noué. The authors have found that the condition can be remedied in leaves—but not in leaves formed after application of the spray—by applying a spray composed of 8-10 parts of lamp-black, 0.3 parts glycerine and 100 parts of water. It is also found that the blackening thus produced entails a heightened temperature in the leaves, and that this in certain varieties causes scorching. The black acts as a sun screen and the authors are now concerned to find out whether spraying with other substances may not provide a satisfactory screen of a different colour which may eliminate the panachure without resulting in scorching.

1042. COCHRAN, L. C., AND SMITH, C. O. 634.25-2.8
Asteroid spot, a new virosis of the peach.

Reprinted from *Phytopathology*, 1938, 28 : 278-81, bibl. 4.

A description is given here of asteroid spot, a new transmissible virus disease affecting peach. It was first observed in 1934 on leaves of a root shoot of a hybrid peach tree at the Citrus Experiment Station, Riverside, California.

1043. ANON. 588.427 : 632.8
"Woodiness" disease of passion fruit.

E. Afr. agric. J., 1938, 3 : 247.

A virus disease causing "woodiness" in the fruit of commercially grown *Passiflora* is becoming troublesome in Kenya. The leaves of infected vines are smaller, twisted, puckered and palely mottled. The foliage symptoms can be seen in seedlings and seed beds should, therefore, be subject to careful inspection and rigorous roguing. Healthy plants should not be touched by hands that have been in contact with the disease. Diseased plants must never be pruned, but should be ring-barked on the main stem and left to die before being removed as completely as possible. After a few weeks the previous site may be replanted since the virus is probably not soil borne.

1044. WORMALD, H. 632.3 : 634.2
Bacterial diseases of stone-fruit trees in Britain. VII. The organisms causing bacterial diseases in sweet cherries.
J. Pomol., 1938, 16 : 280-9, bibl. 8.

The organisms associated with bacterial lesions on sweet cherry trees in Britain have been found to be *Pseudomonas prunicola* and *P. mors-prunorum*, the bacteria causing similar diseases on plum trees. Cultural tests for distinguishing the two organisms are described. For quick tests the organisms are grown in nutrient broth with 5% saccharose, for a colour difference in the turbidity of the resulting growth, and also in a nutrient agar with 5% saccharose, for a longevity test, *P. mors-prunorum* (but not *P. prunicola*) dying out within six days. Inoculation experiments have shown that each organism is able to infect the various parts of a tree liable to attack. Attention is drawn to the relation between the stem canker and the leaf spot phases. [Author's summary.]

1045. DAME, F. 632.314 : 634.1/7
Pseudomonas tumefaciens (Sm. et Towns.) Stev., der Erreger des Wurzelkropfes, in seiner Beziehung zur Wirtspflanze. (*P. tumefaciens*, the agent of crown gall, and its relation to its host.)
Zbl. Bakt. II. Abt. 1938, 98 : 385-429, bibl. 92.

An examination was made of the cytological phenomena seen during the formation of the overgrowths made in the tissues of plants by *Pseudomonas tumefaciens* and is here described in detail.

The growths are compared with those made by the use of growth substances β indoleacetic acid and β indolebutyric acid, etc. Tests were made of the resistance to this fungus of a large number of fruit tree rootstocks, and results are tabulated here. The following showed complete resistance: Northern Spy, 3 *Malus baccata* clones designated as D N 104, 114 and 400, and quince types E(ast) M(alling) B., E.M.G and E.M.F. Another *Malus baccata* clone, DAB 395, gave indications, not yet confirmed, of resistance. No resistant pear clones could be found. Pear varieties in general were particularly susceptible, apples varied in degree of resistance.

1046. HILDEBRAND, E. M. 632.314 : 634.1/2

The blossom blight phase of fire blight and methods of control.

Mem. Cornell agric. Exp. Sta. 207, 1937, pp. 40, bibl. pp. 3.

In 1933-7 fireblight and methods of its control were studied on apples, quinces and pears in New York under laboratory and field conditions. The results of the field experiments indicate that applications of a bactericide always reduce blossom infections and that the time for the most effective single application is at full bloom. Bordeaux mixture 1-3-50 and copper-lime dust 20-80 were the most effective materials tried. In one orchard early- and full-bloom applications reduced blossom blight by 40 and 57% respectively, and the combined early-and-full-bloom treatment by 67%. Full-bloom application gave generally better results than any other single treatment. Under certain conditions, however, the early-bloom application was nearly as important, and two applications proved particularly effective. Cuprous oxide, copper phosphate and Coposil appear promising from limited trials.

1047. HOPKINS, J. C. F. 582.8 + 632.4

A preliminary list of Rhodesian fungi.

Reprinted from *Trans. Rhod. sci. Ass.*, 1938, 35 : 97-127, bibl. 6, 2s. 6d.

This is a list of Rhodesian fungi compiled by the author from various records. The order in which the fungi are arranged is based on Clements' and Shear's "Genera of fungi" (2). The species name is followed by reference to the original description and beneath, in small type, are given locality, collector's number and substratum.

1048. NUSBAUM, C. J., AND KEITT, G. W. 632.42 : 634.11

A cytological study of host-parasite relations of *Venturia inaequalis* on apple leaves.

J. agric. Res., 1938, 56 : 595-618, bibl. 34.

The host-parasite relations of two monoconidial isolates of the apple scab fungi, *Venturia inaequalis*, on the leaves of Fameuse, Yellow Transparent and Missouri Pippin apple trees were observed. The six isolate-variety combinations used showed 4 distinct types of host reaction, namely very susceptible, intermediate and two types of resistant. The course of events in the host cells is discussed at considerable length.

1049. BROOKS, C. 634.37-2.48

Spotting of figs on the market.

J. agric. Res., 1938, 56 : 473-88, bibl. 6.

The spotting of market figs is found to be due mainly to *Alternaria tenuis*, but *Cladosporium herbarum* is also capable of producing spots. Spotting was decreased by lowering the humidity of the store, but satisfactory humidities also caused shrivelling. At 41°, 50°, 59°, 68° and 77° F. exposure to 30% CO₂ reduced the activity of *Alternaria* by two-thirds. With temperature conditions somewhat less satisfactory than those usual during the first two days in a non-precooled car, exposure to atmosphere containing 23% CO₂ or more gave as good control of spotting as immediate storing at 32° F.

1050. PERLBERGER, J. 632.48 : 634.1/2-1.537
***Rhizoctonia bataticola* (Taub.) Butler in deciduous fruit nurseries in Palestine.**

Palestine J. Bot. 1935/36, issued 1937, 1 : 3 : 37-51, bibl. 29.

This is a preliminary report of observations made on the incidence in Palestinian nurseries on apple, pear, quince, apricot, almond, plum, cherry and nut trees of *Rhizoctonia bataticola*. This wilting disease is found to attack nursery stock at the root crown and sometimes to spread downwards to roots and rootlets. It attacks those parts of the trees which have been damaged by overheating in the uppermost layers of the soil. Preliminary experiments indicated that a fair measure of control was obtainable by two treatments of the stems with 3·4% Bordeaux mixture before budding. It is further suggested that young seedlings should be budded in the autumn rather than in the summer, the time when infection mainly takes place.

1051. MOREAU, L., AND VINET, E. 634.8-2.8
 La pression osmotique de la sève et les symptômes du court-noué chez la vigne. (**Osmotic pressure of the sap and the symptoms of court-noué in the vine.**)
C.R. Acad. Agric. Fr., 1938, 24 : 709-14.

Whatever the much debated cause or causes of court-noué in the vine, the following symptoms are always present :—short internodes, bushy growth, small leaves and reduced or absent fruits. A consideration of symptoms indicates that under all circumstances insufficiency of osmotic pressure is actually the direct cause of the condition. Treatment should aim first then at the elimination of the primary cause of the trouble, namely poor soil conditions, and control of such fungi as *Pumilus medullae*. But efforts should also be made to increase the osmotic pressure of the sap at the time of bud burst. In this various cultural treatments might be tried including long pruning, keeping the ground cultivated, root pruning in cases of older vines by means of the subsoiler in every other row together with the application of a complete and adequate dressing of manure at the bottom of the furrow. It might also be possible to delay growth until sufficient rootlets were formed to ensure normal osmotic pressure either by delaying pruning or by coating the pruning wounds with 30% sulphate of iron, or even the young affected shoots might be totally disbudded and the shoots growing to replace them would in some cases be found normal. Finally the use of growth substances might be tried to increase root growth.

1052. BRANAS, J., AND BERNON, G. 634.8-2.8
 Seconde contribution à l'étude du court-noué de la vigne and Troisième ditto.
 (**Second and third contributions to the study of court-noué in the vine.**)
Ann. Éc. Agric. Montpellier, 1936, 24 : 15-56, bibl. 31 and 1937, 24 : 253-7, bibl. 3.

In these two papers, as in an earlier one in *Rev. Path. veg.* 1935, 22 : 24, the authors describe the results of their observations on the tannin content and (in the 3rd paper) on the glucide content of vines affected with court-noué. With regard to tannins they report that at certain moments in the annual growth cycle, the tannin content of certain organs, particularly persistent organs, of vines showing symptoms of court-noué is higher than that of homologous organs of healthy vines. In the same way observations in 1936 showed that the leaves and also the persistent organs of vines suffering from court-noué had a higher content of glucides than homologous organs of healthy vines. It is considered almost certain that this difference was chiefly brought about by the marked increase in reducing sugars.

1053. MEZZETTI, A. 634.13-2.4
 Un marciume di alcune varietà di pere. (**A rot occurring on certain pear varieties.**)
Boll. Staz. Pat. veg. Roma, 1937, 17 : 121-46, bibl. 21.

The author gives a full account of a rotting of pears on the tree found at Grottarossa near Rome. Fungi were isolated and grown in culture plates. The causal agents were identified as *Alternaria tenuis* and *Macrosporium commune*. Both species spread and keep alive naturally by means

of their conidial forms, and also probably through fragments of mycelium, sclerotic fruit bodies, ascospores, and, in the case of *Alternaria*, by chlamydospores. A probable source of infection are the little oiled bags used to protect the fruit from *Cydia pomonella*, *C. molesta* and *Ceratitis capitata*. Before use a second year these should always be thoroughly disinfected.

1054. PRASAD, H. H. 634.13-2.42

A note on soft rot of pears caused by a species of *Aspergillus*.

Indian J. agric. Sci., 1938, 8 : 549-51, bibl. 4.

Severe rotting of pears which occurs in the Delhi market has been traced to a fungus bearing a close resemblance to *Aspergillus japonicus* Saito. The fungus enters as a wound parasite and under favourable conditions can rot pears completely in 4 or 5 days.

1055. BORZINI, G. 632.47 : 634.13

Il "mal di piombo" del pero in Italia. (Silver leaf of pear in Italy.)

Boll. Staz. Pat. veg. Roma, 1936, 16 : 217-24, bibl. 6.

Sul comportamento di alcune varietà di peri inoculate con lo "*Stereum purpureum*" Pers. (The behaviour of certain pear varieties when inoculated with *Stereum purpureum*.)

Ibidem, 1937, 17 : 201-5.

A grave disorder of pears in Lombardy resulting in unhealthiness, infertility and frequently chlorosis and papery appearance of the leaves was identified as due to the silver leaf organism *Stereum purpureum*. In the second paper an account is given of the inoculation of several well-known varieties. They show marked difference in resistance, thus Passe Crassane is very susceptible indeed, Beurré Diel varies in its susceptibility, while Abbé Fétel and Beurré Clairgeau would appear to be absolutely resistant. Inoculation results agree with observations in the orchard. When planting up in places where water is apt to lie stagnant, inoculation methods might prove a useful guide to choice of varieties.

1056. FOISTER, C. E., AND GREGOR, M. J. F. 634.711-2.4

Spur blight of raspberry in Scotland.

Scot. J. Agric., 1938, 21 : 163-6, bibl. 2.

Spur blight of raspberry, caused by *Didymella applanata* (Niessl) Sacc., is here discussed in some detail. Notes are given on the symptoms of the disease, on damage caused, on conditions favouring epidemics and on their control by cutting and burning of old and infected canes, by avoidance of excessive nitrogenous manure, and by spraying with bordeaux mixture.

1057. CYPRUS DEPARTMENT OF AGRICULTURE. 634.11-2.7

Pests of the apple tree.

Cyprus agric. J., 1937, 32 : 101-8.

This article contains descriptions of and control measures against the following pests of the apple tree in Cyprus :—codling moth (*Carpocapsa* (*Cydia*) *pomonella* L.), the small ermine moth (*Hyponomeuta padellus* L.), tingid (also lace bug) (*Stephanitis pyri*, Geoff.), aphids, woolly aphid (*Eriosoma lanigerum*, Hausm.), scale insect (*Parlatoria oleae*, Colv.), wood leopard moth (*Zeuzera pyrina* L.) and blossom weevil (*Anthonomus pomorum* L.).

1058. KUNKEL, L. O. 632.7 : 632.8 : 634.1/2

Insects in relation to diseases of fruit trees and small fruits.

J. econ. Ent., 1938, 31 : 20-3.

The author deals with the relation of *Macropsis trimaculata* and the spread of peach yellows, noting also recent work on the aster leaf hopper *Macrosteles divinus*. He has discovered that the ability of an insect to transmit virus is related to temperature, and exposure to a high temperature for a day may temporarily prevent ability to transmit.

1059. DOTTI, F. 632.78
 La cattura diretta delle larve di *Cydia pomonella* L. (The direct capture of the larvae of the codling moth.)
Riv. Frutticoltura, 1938, 2 : 101-16.

Three years experiments on codling moth control at Massalombarda show that the application of one β naphthol band gives much the same results as that of several such bands. More larvae were caught in the treated than in the untreated bands. The application of β naphthol bands effected a 50% reduction in fruit infested in the first year of application and a very much larger and progressive reduction in succeeding years of treatment. Attempts to control *Cydia molesta* on peach by the same method were unsuccessful, but proved successful in the case of *Cydia pomonella putaminana* on walnut.

1060. BALACHOWSKY, A., AND VIENNOT-BOURGIN, G. 632.78 : 634.11
 Note préliminaire sur la valeur pratique des traitements tardifs dans la lutte contre le carpocapse ou "ver des pommes" (*Laspeyresia pomonella*). (Late treatment for the codlin moth.)
C.R. Acad. Agric. Fr., 1938, 24 : 35-45, bibl. 6.

The authors describe experiments in various orchards in the Valleys of the Seine and the Loire in which late application of arsenical oils proved very effective in controlling codlin moth in apples and pears. For these districts they find the following treatments give a very satisfactory control: 1st application 1 June arsenical oil, 2nd 20 June ditto, 12 July arsenical spray only—no oil, 4th application 1 August arsenical oil. The arsenic used was lead arsenate containing 14-18% As_2O_5 and this was mixed for the oil spray with an emulsion of ultra-refined white summer oil (unsulphonatable residue 98%, av. viscosity 90-95° Saybolt). They were used in the following proportions:—arsenate of lead 0.65-1.0 kg. according to the concentration of the commercial product, white oil 1 litre of concentrated emulsion representing about 90% pure oil, water 100 litres. The last treatment in early August for nearly all the apples is at least 2 months before picking time and the amount of arsenic found on the fruits is negligible and well below the legal limits. The treatment is not recommended for early pears in the case of which, to avoid all danger, the last application must be correspondingly earlier.

1061. MARANI, M., GOIA, G., AND GERBALDI, C. 632.78
 Prova di lotta contro la *Cydia molesta* mediante polveri oleo-sottocalciche. (Trials of two control methods for the oriental fruit moth.)*
Riv. Frutticoltura, 1938, 2 : 145-51.

One method of controlling the oriental fruit moth consisted in removal of infested shoots as previously recommended in northern Italy, the other in dusting with oil dusts (sulphur, hydrated lime and summer Volk). The dusting took place in the month before ripening and was carried out 7 times between 24 July and 26 August. Both cutting back and dusting proved equally successful but the dusting was a good deal more costly.

1062. FLINT, W. P., FARRAR, M. D., AND CHANDLER, S. C. 632.78
 Experiments in the control of oriental fruit moth with oil dusts.
J. econ. Ent., 1938, 31 : 380-2.

The authors summarize results in peach orchards since 1929 with oil dusts consisting of early season dusts: 30 lb. sulphur (300 mesh dusting grade), 25 lb. hydrated lime, 30 lb. talc (300 mesh), 10 lb. lead arsenate and 5 lb. oil (Saybolt 104, 100° F., unsaturated), and late season dusts 60 lb. sulphur, 15 lb. lime, 20 lb. talc and 5 lb. oil. Excellent control was obtained.

* On the lines of work reported by American workers see *J. Econ. Ent.* 1938, 31 : 380-2 (H.A., 8 : 1062).

1063. NEISWANDER, R. B. 632.78 : 634.75
The strawberry leaf roller (*Ancylis comptana* (Froel)) in Ohio.
J. econ. Ent., 1938, **31** : 382-5.

Use of natural or synthetic cryolite proved an effective control for strawberry leaf roller. It may be used in either dust or spray form.

1064. CHRISTIE, J. R. 634.75-2.651.3
Two distinct strains of the nematode (*Aphelenchoides fragariae*) occurring on strawberry plants in the United States.
J. agric. Res., 1938, **57** : 73-80, bibl. 7.

Experiments under Massachusetts' conditions indicate that the dwarf disease of strawberries which occurs in the spring in the Cape Cod district and the similar disease occurring in the summer in the south of the State are caused by two different strains of the strawberry nematode, *Aphelenchoides fragariae*, which are indistinguishable morphologically but differ physiologically.

1065. SAVZDARG, E. E. 632.654.2 : 634.75
Biology of the strawberry mite (*Tarsonemus fragariae* Zimm., *Tarsonemus destructor* Reuter.) [Russian, English summary $\frac{1}{2}$ p.]
Sci. Fruitgrowing, Mitchurinsk, 1938, No. 4, pp. 36-50.

A compilation of data collected in 1927-35 on *Tarsonemus fragariae* Zimm. This strawberry pest has been discovered for the first time in U.S.S.R. recently, but it is thought that it was introduced to that country with imported plants some twenty years ago.

1066. SUIRE, J. 632.78
 Contribution à l'étude des coléophores parasites des arbres fruitiers. (A contribution to the study of *Coleophora* species parasitic on fruit trees.)
Ann. Éc. Agric. Montpellier, 1936, **24** : 137-58, bibl. 31.

The morphology of the small lepidopterous pest of fruit trees, *Coleophora hemerobiella* and some eight variant forms of it are given here. Its life history, parasites and methods of control are discussed.

1067. BARY, P., AND CORNU, C. 632.95
 L'emploi des colloïdes en agriculture. (The use of colloidal suspensions in agriculture.) [English summary 4 lines.]
Riv. Frutticoltura, 1938, **2**, 23-7, 179-82.

To spray plants with dissolved salts is usually unsafe and the effect of the material applied is transitory. On the other hand, suspensions of solid substances do not normally exhibit a high degree of activity. It is desirable, therefore, to produce some form of preparation intermediate between solution and suspension that shall possess the virtues of both and the deficiencies of neither. Colloidal suspensions seem to meet the requirements, for while the material is present in an insoluble form its activity is so enhanced by reduction of particle size as to approach that of solutions. Practical difficulties of obtaining a stable colloid in concentrated form are, however, a serious obstacle. Colloidal preparations tend to age rapidly and to lose their characteristic properties by aggregation of the particles. Further, the introduction of protective colloids to stabilize preparations has an unfavourable effect on the initial retention and the tenacity of spray deposits. The authors conclude that the best way to take advantage of the unique properties of colloidal suspensions is to produce them immediately before they are to be applied. In the case of burgundy mixture, this may be achieved by drawing solutions of copper sulphate and of sodium carbonate, in equivalent quantities, from separate containers and mixing them just before they enter the spraying lance. The material is thus applied in its most active form before flocculation of the precipitate can occur.

H.S.

1068. JAMALAINEN, E. A. 632.95
 Kasvinsuojeluaineiden tarkastus Tanskassa ja Saksassa. (**Examination of plant protective materials in Denmark and Germany.**) [Finnish, German summary pp. 4 $\frac{1}{2}$.]
Valt. Maatalousk. Julk. 97, 1938, pp. 32, bibl. pp. 3.

The author advocates introduction of a government control in Finland for chemicals used in plant protection on similar lines to those in force in Denmark and Germany.

1069. PAILLOT, A. 632.951.8+541.18
 L'emploi en agriculture des émulsions d'huile. (**The use of oil emulsions in agriculture.**)
C.R. Acad. Agric. Fr., 1938, 24 : 73-6.

The author deals with some of the more important uses of oil emulsions made with arachis oil, paraffin, etc., in the control of fruit pests.

1070. DOTTI, F. 634.22-2.793
 Ulteriori ricerche sul valore insetticida dell'infuso di legno quassio. (**Further investigations* on the insecticidal value of infusion of quassia wood.**)
Riv. Frutticoltura, 1938, 2 : 29-33.

Spraying pears in full flower twice at an interval of 8 days with a 2% infusion of quassia wood reduced infection by the sawfly *Hoplocampa brevis* from 31.56% to 3.35%. The effects of the same 2% infusion on codling moth were, however, very inferior to those of arsenate of lead. The experimental material consisted in the first case of some 13 controls and 10 treated trees, in the second of single trees for each treatment only.

1071. MARTIN, H. 632.95
Detergents and wetting-out agents as assistants in plant pest control.
 Reprinted from *Wetting and Detergency*, 1937, pp. 117-135, bibl. 29.

This paper reviews recent work on both theoretical and practical aspects of wetting agents applied to plant pest control. The nature and mode of action of spray fluids and the function of spray supplements are summarized and the essential requirements of the latter are indicated. Theories of "wetting", "spreading" and "penetration" are discussed and practical methods for assessing these properties are described. The influence of spray supplements on initial retention, tenacity and coverage is considered and data are presented illustrating the performance in both laboratory and field of a number of commercial products. Several groups, namely the soaps, the synthetics, the by-products and the oils are compared and contrasted, especially in the light of practical considerations. The potential consumption of spray supplements is indicated by commercial data relating to spray materials.

H.S.

1072. ROSEN, H. R. 632.314
Life span and morphology of fire blight bacteria as influenced by relative humidity, temperature and nutrition.
J. agric. Res., 1938, 56 : 239-58, bibl. 21.
 GOLDSWORTHY, M. C., AND GREEN, E. L. 632.41 : 632.952.2
Effect of low concentrations of copper on germination and growth of conidia of *Sclerotinia fructicola* and *Glomerella cingulata*.
J. agric. Res., 1938, 56 : 489-505, bibl. 15.
 HAMMER, O. H. 632.752 : 634.11
The scurfy scale (*Chionaspis furfura* Fitch) and its control.
J. econ. Ent., 1938, 31 : 244-9, bibl. 1.

* *Ibidem*, 1937, 1 : 29-33, H.A., 7 : 906.

1072. STEINER, H. M. 632.754 : 634.11
Effects of orchard practices on natural enemies of the white apple leaf hopper.
J. econ. Ent., 1938, 31 : 232-40, bibl. 8.
- RITCHER, P. O. 632.76 : 634.75
Biology and control of the strawberry crown borer (*Tyloclerma fragariae* (Riley) in Kentucky.
J. econ. Ent., 1938, 31 : 385-8, bibl. 1.
- HOUGH, W. S. 632.78
The use of nicotine in codling moth control with special reference to its effectiveness in killing moths.
J. econ. Ent., 1938, 31 : 216-21, bibl. 12.
- DRIGGERS, B. F., AND O'NEILL, W. J. 632.78
Codling moth parasitism under different spray treatments.
J. econ. Ent., 1938, 31 : 221-3, bibl. 3.
- HARMAN, S. W., AND MOORE, J. B. 632.78
Further studies with lead arsenate substitutes for codling moth control.
J. econ. Ent., 1938, 31 : 223-6.
- SCHOENE, W. J. 632.754 : 634.11
Ecological studies of the white apple leaf hopper (*Typhlocyba pomaria* McAtee).
J. econ. Ent., 1938, 31 : 229-32, bibl. 4.
- ISELY, D. 632.78
Codling moth oviposition and temperature.
J. econ. Ent., 1938, 31 : 356-9.
- MARSHALL, G. E., AND HIENTON, T. E. 632.78
The kind of radiation most attractive to the codling moth : a progress report.
J. econ. Ent., pp. 360-6, bibl. 4.
- STEINER, L. F., AND SAZAMA, R. F. 632.78
Experiments with tank-mix nicotine-bentonite-soybean oil for codling moth control.
J. econ. Ent., pp. 366-74, bibl. 3.
- HUTSON, R., MERRITT, J. M., AND PARMELEE, F. 632.78
Comparative tests of fixed nicotine and lead arsenate against codling moth.
J. econ. Ent., pp. 374-8, bibl. 3.
- HARTZELL, F. Z., MOORE, J. B., AND GREENWOOD, D. E. 632.78 : 634.11
Control of eye-spotted bud moth (*Spilonota ocellana* (D. and S.)) on apple by lubricating oil containing dinitro-o-cyclohexylphenol.
J. econ. Ent., 1938, 31 : 249-53, bibl. 2.
- DEAN, R. W. 632.77 : 634.11
Experiments on rearing apple maggot (*Rhagoletis pomonella*) adults.
J. econ. Ent., 1938, 31 : 241-4, bibl. 5.
- DOWDEN, P. B. 632.78 : 632.96
***Rogas unicolor* (Wesn.), a Braconid parasite of the satin moth (*Stilpnotia salicis* L.)**
J. agric. Res., 1938, 56 : 523-35, bibl. 12.
- LILLEY, J. H. 634.11 : 632.951.4 : 615.778.524/5
A method for measuring effects of dormant sprays upon apple tree growth.
J. econ. Ent., 1938, 31 : 388-93, bibl. 13.
- GINSBURG, J. M., AND DRIGGERS, B. F. 634.11 : 632.951.4 : 615.778.524/5
Coal tar distillates in dormant and delayed dormant sprays on apple trees.
J. econ. Ent., 1938, 31 : 393-400, bibl. 16.

VEGETABLE GROWING.

1073. ODLAND, M. L. 581.142 : 635.1/7

Observations on dormancy in vegetable seed.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, **35** : 562-5, bibl.5.

Seed of cucurbits seems to undergo a period of weak germination of several weeks duration after harvest ; older seed germinates promptly and strongly. Carrots, tomatoes and peppers (*Capsicum*) did not exhibit this dormant period.

1074. THOMPSON, R. C., AND KOSAR, W. F. 635.52 : 631.53 : 577.15.04

The germination of lettuce seed stimulated by chemical treatment.

Science, 1938, **87** : 218-9.

The authors give a brief account of successful attempts to promote prompt germination in dormant lettuce seed. The four most successful compounds used were thiourea, allyl thiourea, ammonium thiocyanate and potassium thiocyanate, the optimum concentration being found to be 0.5%. Some other compounds, including urea, sodium nitrate, ammonium sulphate, potassium ferricyanide, potassium ferrocyanide and calcium sulphate, proved much less successful. Although thiourea gave the greatest increase in germination over the control, the development, unlike the normal development following stimulation by the other three compounds, was abnormal, the hypocotyl elongating more quickly than the radical which in some cases did not develop at all.

1075. THOMPSON, R. C. 635.52 : 631.53

The germination of lettuce seed as affected by nutrition of the plant and the physiological age of the plant.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, **35** : 599-600.

Data are presented which indicate that the development of dormant seed in the lettuce variety Grand Rapids is influenced both by the time and the amount of fertilizer applied and the stage of development of the plant during the time the seed matures. Thus 20 grams per plant of 5 : 8 : 5 fertilizer applied at planting out resulted in a significant increase in germination over untreated plants. An additional 20 grams applied just before flowering, i.e. on the appearance of the lateral branches, resulted in a significant increase in germination over plants receiving fertilizer only at planting time. As far as size and weight of seeds are concerned the first harvest of seed proved, as is often asserted in commercial practice, superior to the second, but as regards germination the second harvest seed in these experiments was, contrary to established ideas, superior.

1076. OWEN, O. 632.954

Chemical problems.

635.64 : 631.8

Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 66-9.

1. *General.* Examination has been asked for and made on soils, water, fertilizers and plunging materials. 2. *Chlorate weed killers.* The serious latent effect of chlorate weed killers is noted. 3. *Loss of nitrogen from tomato soil.* It is hoped to obtain detailed and accurate results on this during the year. 4. *Effect of manurial treatment on the composition of lettuce.* In general compared with plants growing in soil treated with complete artificials those in soil from which any one nutrient is withheld take up less of all nutrients. It may be noted that plants receiving no nitrogen take up more nitrogen than those which receive no phosphates and no potash respectively.

1077. BEWLEY, W. F. 631.544

Experimental results of 1937. IV. Soil warming under frames.

Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 32-7.

The soil is heated by a system of small pipes through which hot water is circulated by means of an electric pump regulated by thermostats in the soil. Results with narcissi and tulip bulbs,

strawberries, carrots and lettuce are discussed. They were extremely encouraging in the case of lettuce showing that more rapid growth occurs in the warmer soils and that with sufficient knowledge warming the soil may prove of considerable service to the commercial grower.

1078. TIEDJENS, V. A., AND SCHERMERHORN, L. G. 635.1/7 : 631.454

Notes on nutrient deficiencies of some vegetable crops.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 704-8.

The gross visual symptoms of nutritional deficiency in certain vegetable crops in New Jersey are recorded. *Nitrogen deficiency* symptoms in general were similar in most crops and consisted of a loss of green colour from the mature leaves, causing yellow or purplish pigment, normally masked by the chlorophyll, to appear. Plants became stunted and yields lowered. An extensive development of the roots distinguished nitrogen from other deficiencies. *Magnesium deficiency* was difficult to distinguish by leaf colour in celery, carrots and beets from nitrogen deficiency, but mature cabbage, tomato and cucumber leaves produced characteristic symptoms. The veins remained dark green while the areas between turned yellow, whereas in nitrogen deficiency the entire leaf faded uniformly to light yellow. The yellow blotches were followed by scorching of the leaf margins at random and by leaf fall in those varieties which form a natural abscission zone at the base of the petiole. The fibrous roots of most plants showing magnesium deficiency were long and stringy, and in the case of the larger roots brownish red in colour. *Phosphorus deficiency* was indicated by stunted growth and an intense dark green colour followed by the appearance of a purplish pigment in the meristematic regions of the stem. *Potassium deficiency* caused an early retardation of growth, followed by a stimulation which softened the plants. A sprinkling of brown spots appeared on the older leaves followed by enlarged dead areas round the margins of the leaves. Cabbage heads were small, soft and puffy with some yellowing of the older leaves. Fibrous roots were long and slender. *Calcium deficiency* resulted in greater injury to the plants than any other deficiency. The roots turned brown and dried and the new root primordia made only short stubby growth often with bulbous tips. The shoot tips burned off and water-soaked areas appeared along the veins in tomato. In carrots and beets a multiple crown was produced. In celery plants the hearts died in two weeks. Cabbage failed to form heads. *Iron deficiency* symptoms consisted of a yellow-green colour of the growing tips of carrot, beet and celery. *Boron deficiency* was shown in celery by death of the growing tip followed by cracked stems and petioles. In carrots, beets and cabbage the growing tip died. In beet and cabbage cracking of the midrib occurred but was less pronounced than in celery. There are, however, a number of symptoms occurring on plants grown on completely fertilized soil which cannot be attributed to any one element and often obscure the real cause of abnormal growth. Factors such as salt concentration, drainage, aeration, temperature, soil structure, lack of humus, planting out of overgrown seedlings in soils of high temperature and faulty cultural practices often cause stunting in plants.

1079. BOISCHOT, P., AND DROUINEAU, A. 631.811.7 : 635.1/7
 Sur l'action fertilisante du soufre élémentaire dans la culture maraîchère en sols calcaires. (**The manurial action of elemental sulphur in market gardens on calcareous soil.**)

C.R. Acad. Agric. Fr., 1938, 24 : 336-40, bibl. 5.

There is plenty of experimental evidence of the good effects of the application of sulphur to market garden soils, even though the cause remains somewhat obscure. Trials have now been in progress on the argilo-calcareous soils of the Grasse Experimental Garden for four years to determine whether it is better to apply flowers of sulphur or colloidal sulphur. In the trials, which were replicated, plots of 25 square metres were used. The flowers of sulphur were broadcast and lightly harrowed in. The colloidal sulphur was applied by watering. The applications were made just before planting in the case of leeks and tomatoes, and during sowing for potatoes, beans and garlic. Results showed that in non-irrigated cultures flowers of sulphur is definitely superior to colloidal sulphur, except in the case of garlic where effects were the same.

In irrigated crops, however, colloidal sulphur showed great superiority in the case of tomatoes and to a lesser extent in that of potatoes. Neller's observations that nitrogen content of legumes is increased by the use of sulphur was not confirmed.

1080. MOLLIARD, M. 631.811.92
 La fumure carbonique. (**CO₂ manuring.**)
C.R. Acad. Agric. Fr., 1938, **24** : 400-4.

The author notes his own work on radish and suggests that expensive fruits and vegetables, normally grown under glass might economically be submitted during growth to atmospheres artificially enriched with CO₂.

1081. MATHIEU, G. 631.67 : 635.1/7
 Observations sur l'irrigation souterraine (**Underground irrigation**), and Résultats obtenus dans l'irrigation souterraine en Provence. (**Results obtained with underground irrigation in Provence.**)
C.R. Acad. Agric. Fr., 1937, **23** : 752-6, and *Ibidem*, 1938, **24** : 86-91.

In his first paper the author draws attention to the happy results of underground irrigation on the physical and chemical properties of saline soils in Algeria and in Provence. In the second he discusses in more detail results with an improved system called "de Cavaillon", which essentially consists of a series of ordinary pot drain pipes with open joints and has been successfully used for the last four years in market gardens at Avignon and other centres in Provence. Results of single comparative trials of overhead watering and underground irrigation with potatoes, melons, chicory, cabbages, eggplant and tomatoes greatly favour the underground system which has, moreover, been very successfully used for jasmine growing at the Grasse Jardin d'Essais and shows great promise for the growth of plants from seed especially in conjunction with sterilized and heated soil. It is claimed that the superiority of the underground method lies in the good effects which it has on the physical, chemical and biological properties of the soil when compared with those of overhead watering.

1082. ZAOSTROVSKAYA, E. N., TAL'KOVSKY, A. I., AND METLITSKY, L. V. 664.84 : 551.566.3
Fresh vegetables as affected by transport to the Arctic. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 8-9, pp. 43-5.
 ALEXANDROV, S. V. 635.1/9 : 631.544 : 551.566.3
Glasshouse trials in the Arctic. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 8-9, pp. 40-3.

In the first article the methods adopted in transport of vegetables to the Arctic are discussed in some detail, certain changes in procedure being suggested. In the second an account is given of vegetable and flower growing in glasshouses on Dickson Island situated 73° 30' north. lat. and 80° 23' east. long.

1083. GRANOVSKY, A. A. 632.7 : 632.8 : 635.1/7
Insects in relation to disease of truck crops.
J. econ. Ent., 1938, **31** : 11-9, bibl. 31, being *Paper No. 1581* of the Scientific Journal Series of the Minnesota agric. Exp. Sta.

The author in considering the transmission of disease by insects deals first with the external and internal anatomy of insects which allows them to spread disease and then turns to the modes of transmission adopted. These are: (1) simple dissemination without wounding; (2) dissemination accompanied by wounding; (3) infestation without dissemination of pathogens. A large number of truck crop diseases are spread by the 2 former modes of transmission and are here discussed. In addition there are a number of diseases apparently due to the feeding action of sucking insects, where opinion differs as to whether toxins are introduced into the plant or such physiological disturbances are set up that every appearance of disease is given. These also are considered.

1084. SPEYER, E. R. 632.654.3

A predator upon the red spider mite.

Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, p. 63.

A consignment of living *Scolothrips sexmaculatus*, a predator upon the red spider, has been introduced, but no sign of its increase has been seen yet.

1085. HØYGAARD, A., AND RASMUSSEN, H. W. 635.34 + 633.491 : 577.16

Inhibiting effect of sodium ehloride on the oxidation of ascorbic acid.

Nature, 1938, **142** : 293, bibl. 7.

The authors note experiments in which vegetables, namely potatoes and cabbage, kept their ascorbic acid better when cooked in water containing salt (NaCl) than when cooked in distilled water.

1086. AINSWORTH, G. C. 632.8

• **Virus diseases.**

Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 54-7.

Lettuce mosaic. Infected seed would appear to be the chief source of mosaic infection in lettuces grown under glass and aphides to be responsible for subsequent spread. The use of virus-free seed or the examination of seedlings prior to transplanting should suffice to control it in glass-houses. In the field roguing mosaic-diseased plants at an early stage and planting when and where aphid attack is likely to be least are suggested. *Lily-mosaic.* In the author's opinion lily-mosaic virus differs sufficiently from cucumber virus to justify its designation as a special strain. *Tobacco necrosis.* Affected plants show no sign of disease except necrotic markings on the lowest leaves and otherwise they make normal growth.

1087. BEATTIE, J. H., AND BEATTIE, W. R. 633.44

Production of parsnips.

Leaflet. U.S. Dep. Agric., **154**, 1938, pp. 4.

This leaflet deals with the cultivation of parsnips, the main points being discussed under the following captions: Importance and distribution; soils and fertilizers; varieties and seed; cultivation; harvesting and storage.

1088. MIÈGE, E. 664.84.21.037 + 633.491

Influence du froid artificiel sur la conservation et la productivité des tubercules de pommes de terre au Maroc. (The effect of cold storage on seed potato productivity.)

C.R. Acad. Agric. Fr., 1938, **24** : 565-75, bibl. 3.

An account is given of successful experiments in which the storage of seed potatoes from about mid-June to the end of September at a temperature of +3° C. and humidity 85° resulted in a very much better sample of seed and later much healthier plants than were obtainable from seed potatoes merely kept at ordinary temperatures in sand. These experiments confirm experience in Italy and in Algeria.

1089. BEATTIE, J. H., AND BEATTIE, W. R. 635.15

Production of radishes.

Leaflet. U.S. Dep. Agric., **157**, 1938, pp. 4.

The following points in the cultivation of radishes are noted: climatic and soil requirements, fertilizers, radish types and varieties, seed, sowing, cultivation, pests and diseases, harvesting, bunching and forcing.

1090. SPEYER, E. R. 632.73 : 635.25

Onion thrips.

Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 62-3.

The egg-laying habits of the onion thrips (*Thrips tabaci*) are discussed.

1091. TOMPKINS, C. M., AND THOMAS, H. R. 635.34 : 632.8
A mosaic disease of Chinese cabbage (*Brassica Pe-tsai* Bailey).
J. agric. Res., 1938, **56** : 541-51, bibl. 14.

Studies of this disease are reported and a comparison is made with certain other crucifer viruses.

1092. HARTMAN, J. D. 632.19 : 546.27 : 635.35 + 635.41
Boron deficiency of cauliflower and spinach on Long Island.
Proc. Amer. Soc. hort. Sci. for 1937, 1938, **35** : 518-25, bibl. 3.

The chief symptom of boron deficiency in cauliflower is internal brown spotting, with or without surface discolouration of the head and hollow stem. Spinach is more sensitive to a great many mineral deficiencies than any other common vegetable plant. It is particularly sensitive to boron deficiency and is, therefore, on occasion, a useful experimental plant.

1093. LEWIS, A. H. 635.36 : 631.8
The uptake of nutrients by brussels sprouts.
J. Minist. Agric., Lond., 1938, **45** : 262-8, bibl. 5.

A crop of brussels sprouts was found to remove from the soil during one season 200-300 lb. N, 60-90 lb. P₂O₅, 170-240 lb. K₂O and 170-270 lb. CaO per acre. Only small amounts of nutrients are absorbed by the crop in the first 6-8 weeks after transplanting, while very large amounts are absorbed during the third and fourth month of growth. Owing to this relatively restricted period of high demand for nutrients in an available form, heavy dressings of N, P and K fertilizers should be highly effective if applied about 4-6 and 8-10 weeks after transplanting. The nitrogen and phosphorus contents of the crop increase until picking of the sprouts is completed, whereas potassium uptake ceases after October. The calcium content of the crop increases rapidly to a maximum in September-October, and then markedly falls owing to leaf-fall. Absence of a corresponding decrease in N, P and K shows that these elements have moved from the moribund leaves to the developing sprouts which are very low in calcium content. There are indications that a high calcium content is associated with senescence. The sprout crop uses its leaves to get rid of excess calcium. While a certain amount of this mineral is necessary to maintain the pH of the soil at a suitable level and to regulate the uptake of other ions, large amounts do not appear to be needed in the plant and may, in fact, be harmful. The ratio of true to crude protein shows a slight fall during the season, whereas the organic fraction of the phosphorus shows a steady, marked increase.

1094. PETHERBRIDGE, F. R., AND WRIGHT, D. W. 632.753 : 635.34
The cabbage aphid (*Brevicoryne brassicae* L.).
J. Minist. Agric., Lond., 1938, **45** : 140-8, bibl. 2.

This is an illustrated and tabulated account of the cabbage aphid (*Brevicoryne brassicae* L.), a pest causing serious damage to cabbage and related crops in Great Britain. The life history of the insect, its host plants and the damage done by it are described. Certain control measures consisting of dusting and spraying seed and plants and removal and destruction of old and infested *Brassica* plants, are recommended. The need for special legislation to restrict the production of *Brassica* seed crops (and especially brussels sprouts) to alternate years is indicated.

1095. ANON. 635.52 : 631.564
The marketing of home-grown cabbage lettuce : examination of market packs.
J. Minist. Agric., Lond., 1938, **45** : 149-54.*

As a result of an examination of the packs at a London market the following conclusions were reached: The top layer of lettuces in the package is often deceptive and is not thoroughly representative of the contents. The packs of good general appearance are not always the best. Carelessly packed crates may contain some of the best lettuces. There is need for the wider adoption of the National Mark Scheme in the interests of both growers and buyers, but in order that packs shall comply with National Mark standards a little more attention to detail is needed in (i) selection of the lettuces by the cutters in the field, (ii) trimming the products, (iii) preventing the leaves from becoming muddy and unsightly, and (iv) general presentation.

* + 12 plates.

1096. BARBIER, G., AND MARCEL, M. 635.561 : 631.8
 Sur la fumure des cressonnières. (**Manuring water cress beds.**)
C.R. Acad. Agric. Fr., 1938, **24** : 193-200.

Samples taken from experimental and commercial water cress beds at Versailles and in the Department of Oise have shown that ample nitrogen and potassium is available in the waters which run through the beds. There is, however, a lack of phosphorus. This, it is considered, could be best given in the form of slow dissolving phosphates such as slag or bicalcium phosphates. Such phosphates are available in powdered form, but this offers a slight risk of leaf damage. A finely granulated bicalcic phosphate would probably be the most suitable of all. It is also suggested that ammonium-magnesium phosphate might be very good, but it would have to be applied in fairly large granules, as in powdered form it would be too soluble.

1097. SNITKO, E. Z. 635.63 : 631.531.14
A machine for extracting cucumber seed. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 7, pp. 25-6.

An illustrated description of a new machine, already in use in U.S.S.R., which greatly facilitates the entire process of extracting seed from cucumber.

1098. BEWLEY, W. F. 635.63 : 612.014.44
Experimental results of 1937. II. Cucumbers.
Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 27-32, and
Experiments on irradiation.
Ibidem, pp. 70-2.

Young plants in the propagating house were treated with electric light from 500 watt gas-filled lamps mounted in parabolic reflectors from 4 p.m. to 8 p.m. each evening. Although the production of fruit was somewhat greater in February from the plants irradiated with 280 foot candles or with 70 foot candles, that in March was greater from the control plants than from either of the treated lots. The total weight picked is, moreover, not usually higher from irradiated plants and irradiation would not appear to be a commercial proposition.

1099. WILLIAMS, P. H. 635.63 : 632.48
Cucumber root rot.
Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 43-5.

Inoculation experiments with bacteria and seven forms of *Fusarium* indicate that many of the organisms isolated are weak pathogens and cause injury only under conditions unfavourable to the growth of the cucumbers. Further trials in which waterlogged conditions were established suggest that unfavourable physical conditions in the soil may cause the death of cucumber roots without the presence of an actively parasitic organism. This possibility is being investigated.

1100. BEWLEY, W. F. 635.64
Experimental results of 1937. I. Tomatoes.
Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 19-27.

Root restriction experiment. There are indications that the use of cardboard containers is worth consideration by growers. Those used in these experiments were 8 in. × 8 in. × 10 in. **Distance of planting.** Results to date suggest that the standard method of planting in rows 18 in. apart with paths 27 in. between double rows and allowing 14 in. between plants in the rows possibly results in overcrowding. Setting of fruit was not so good in the widest spacing used probably owing to the dryness of atmosphere near the flowers. **Soil sterilization and warming.** Notes are given on the effects on crop of different methods of sterilizing the soil for the removal particularly of *Heterodera marioni* and *Verticillium albo-atrum*. **Variety trials.** One or two crosses are now selected as showing both good shape of fruit and high resistance to *Cladosporium fulvum*.

1101. MOEN, O. 635.64 : 631.67
 Forsøk med undervanning til tomater i hus. (**Underground watering of tomatoes in the glass house.**)

Reprinted from *Meld. Norg. LandbrHøisk. 1938*, pp. 8, bibl. 5.

In 1934-7 underground watering of tomatoes was tried in a 348 m² glasshouse at Ballerud (Norway). The water pipes were laid 35 cm. deep and 80 cm. apart. They were placed on cardboard channels and were covered with peat. In order to keep the soil sufficiently moist 33 litres of water were given weekly per 1 square metre during the warmest season. This quantity was double that needed for the maintenance of the same soil moisture in the control glasshouse of equal size watered by means of an ordinary hose. Tomato yields were somewhat smaller when the underground watering method was employed. This is partly attributed to a better root development of the controls, particularly of surface roots. Air humidity of the two glasshouses was much the same, in spite of the fact that the whole surface of the soil in the control glasshouse became moist every time the tomatoes were watered. This is thought to be due to the fact that tomato plants were distributed over the greater part of the evaporating soil surface. Underground watering saved much labour, requiring only one-sixth of the time necessary for hose-spraying tomatoes.

1102. FOSTER, A. C., AND TATMAN, E. C. 635.64 : 581.192 : 581.02
Influence of certain environmental conditions on congestion of starch in tomato plant stems.

J. agric. Res., 1938, 56 : 869-81, bibl. 7.

The authors describe an intensive study on starch congestion or accumulation in the stems of tomato plants, the growth response of the plants to various environmental influences and the inter-relation and interaction of these factors as influenced by (1) 4 soil-fertilizer treatments, (2) 3 soil-moisture treatments, and (3) 3 air-temperature treatments.

1103. PHILLIPS, W. R. 635.64 : 546.27
The effect of boron on the respiratory behaviour of tomatoes.

Sci. Agric., 1938, 18 : 738-40, bibl. 2.

These experiments with Bonny Best, though suffering a setback through inadvertent moving of tomatoes into an unshaded greenhouse when the fruit on the first trees was still green and small, afforded the following indications of the effect of boron. It may be assumed to produce a steadying effect on CO₂ output. If given to excess the rates appear steadier than if boron is lacking, but they assume a higher level. Boron administered in proper amount produces a low steady rate, which appears to be conducive to better keeping qualities.

1104. GOODALL, D. W. 635.64 : 581.145.1
Further observations on factors affecting the position of the first inflorescence in the tomato.

Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 73-8.

Light. It seems probable from observations made and here shown graphically that the greater number of leaves below the first truss in plants grown in mid-winter may be partly ascribed to low light intensity. *Condition of the seed.* The indication in the author's report last year (*Ibidem* 1936, 1937, pp. 87-92, *H.A.*, 8 : 138) that the age of the seed affects the stage at which flowering takes place is fully confirmed. An attempt to reproduce the effect of aging by artificial means, i.e. subjecting the dry seeds to high temperatures, is described.

1105. BAKER, C. E. 635.64 : 631.85
Early fruiting of tomatoes as induced by the use of soluble phosphate.

Proc. Amer. Soc. hort. Sci. for 1937, 1938, 35 : 668-72.

From tests with field grown tomatoes in Indiana it was plainly indicated that on some soils relatively low in available phosphorus the use of phosphoric acid and soluble phosphate at

transplanting time produces earlier growth and fruiting, reduces the need for replacements and increases yield. The treatment may also prove beneficial to other long season crops where early maturity is desired.

1106. WOODS, J. J. 635.64 : 631.542

Pruning staked tomatoes.

Sci. Agric., 1938, **18** : 620-6, bibl. 7.

The experiments concerned staked tomatoes grown in the open for table use. Various methods of pruning are described which were tried in order to produce the earliest possible crop. The variety used, except for one year, when a mistake was made, was Bonny Best. The period covered was 1927-36, there being no crop in 1934 owing to blight. The author summarizes his results as follows : 1. Maturity is hastened by the most severe pruning practices. 2. Commensurate with yields and sunscald injury too severe pruning can be done. 3. Delayed pruning gives increased yields. 4. Unchecked plants trained to a single stem have given the most satisfactory results, considering earliness and total yield. 5. The evidence, while fragmentary, indicates the possibility of varietal differences in response to pruning.

1107. AINSWORTH, G. C., AND OYLER, E. 632.482 : 635.64

The spotting of tomato fruits by *Botrytis*.*

Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 46-8.

The presence of *Botrytis* spores and of excessive moisture is necessary before spotting can occur. The source of spores are infected snags and plant debris resulting from careless pruning. Excessive humidity often results from incorrect ventilation. Control is thus largely a matter of employing the best horticultural practice in growing the tomatoes.

1108. COHEN, M. 635.64 : 632.77

The tomato leaf miner and its control.

J. Minist. Agric., Lond., 1938, **45** : 460-2, bibl. 3.

This is an illustrated description of the tomato leaf miner (*Liriomyza solani* Macq.). Notes on the life history and the hosts of this insect are given. Damage and control measures consisting of fumigation with hydrocyanic acid gas or with nicotine are discussed.

1109. WHITE, H. L. 635.651/3 : 632.3/4 + 634.8

Diseases of beans in glasshouses.

Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 53-4.

The diseases discussed are halo blight (*Bacterium Medicaginis*), foot rot (?*Fusarium Solani*, *Martii*) and mosaic.

1110. COCHRAN, H. L. 633.842 : 581.145

A morphological study of flower and seed development in pepper.

J. agric. Res., 1938, **56** : 395-419, bibl. 28.

The flower and seed development of pepper (*Capsicum frutescens* L.) var. World Beater, are traced, with copious illustrations, from the initiation of the flower bud through pollination to the perfectly formed seed.

1111. DAVIS, A. C. 635.8 : 632.7

Mushroom pests and their control.

Circ. U.S. Dep. Agric., **457**, 1938, pp. 22.

This circular deals with the insects and mites that attack mushrooms and their control. The more important pests of cultivated mushrooms in the United States are :—Mushroom flies (*Sciariidae*), manure flies (*Phoridae*), the mushroom mite (*Tyroglyphus* sp.) and the long-legged mite (*Linopodes antennaeipes*).

* See also H.A., 8 : 783.

1112. CURTIS, K. M., AND ALLAN, J. M. 633.71-2.8
Tobacco mosaic in New Zealand.
N.Z. J. Sci. Tech., 1938, 20 : 1A-13A.

Under glasshouse conditions mosaic did not appear in seedling tobacco in beds treated with formalin. Even a few infected seedlings in a seedling pricking out bed were shown greatly to increase the multiplication of mosaic in the field. Handling and cultural operations after planting in the field, while spreading mosaic, were of less importance than the equivalent operations at bed phase, since secondary field infection took place too late to impair seriously the development of the crop leaves.

FLOWER GROWING.*

1113. BOISCHOT, P. 633.811
Le jasmin. (**Jasmine cultivation.**)
Prog. agric. vitic., 1938, 109 : 367-70, 399-401.

The jasmine cultivated for essential oil extraction in the south of France is *Jasminum grandiflorum*. It was probably introduced from Spain. It is grafted on *Jasminum officinale*, the exact procedure being set out here. Among other cultural operations described are :—earthing up to prevent frost damage, removal of earth, pruning and tying, irrigating—either by means of the water from special water channels made of concrete or pottery or by the several methods devised for provision of water in the neighbourhood—application of fertilizer, namely sulphate of ammonia, ploughing in June-July, two hoeings at the time of picking. A disease for which the only known remedy appears to be the application of large amounts of sulphate of iron is a root rot caused by *Rosellinia aquilla* and *Rosellinia necatrix*. *Glyphodes unionalis* is a small white lepidopterous pest, whose larvae eat the flowers and buds and have been known to do much damage. The use of arsenicals on cultivated flowers is forbidden and the search for an alternative continues, the chief difficulty being the necessity for something which will not leave any trace or odour on the flowers. In a normal year the value of the jasmine harvest in the Alpes-Maritimes amounts to 20 million francs. Brief notes are given on the extraction processes after harvesting.

1114. BOISCHOT, P. 633.811
La rose à parfum. (**Rose growing for the production of scent.**)
Prog. agric. vitic., 1938, 109 : 162-5.

The only rose cultivated for scent production in the region of Grasse, southern France, is the so called Rose de Mai which is probably a hybrid between *R. gallica* and *R. centifolia*. The same variety is also used in Bulgaria, Persia and Tunis. In France they distinguish 3 strains, viz. Le Lunier, a poor strain now discarded ; the thorny type ; and the so-called thornless type, in which actually there are thorns but fewer. Most of the roses are on their own roots, a small area only being planted with roses grafted on *R. indica major*. Propagation is done by means of rooted suckers about 45 cm. long which are planted out in December or January 40 cm. apart in rows 0.90 m. distant from one another or 1.20 m. when garden crops are to be grown between the rows. This gives 20,000 to 28,000 per hectare. Failures, however, average about 20%, being largely due to attack by *Agrilus viridis*, a buprestid beetle, and they are replaced in December. A half crop may be expected the year following planting. The flowers are carried on the young wood, hence after flowering the normal procedure is to cut away the dead wood and only retain three or four long shoots on each plant to furnish the flower buds for the following year. Cultural practice includes tying of the long shoots of one plant to those of the next and thus forming arcs along the line of the rows. Ploughing is done twice, once in autumn and once in March, and although it would be better to apply manure in autumn it is generally applied in March. Two hand hoeings are carried out and, if there are no crops between the rows, 2 or 3 irrigations are often given during the dry season. The chief pests are in the early stages the

* See also 934.

beetle *Agrilus viridis*, the remedy suggested being to plant only uninfested suckers, and tortrix and other larvae which eat the buds and may destroy 30% of the crop. Spraying with pyrethrum or lead arsenic solution gives adequate control. As regards fungi, rust is sometimes noticeable but is on the whole not very important and does not justify control measures. It is calculated that to lay out a hectare would involve a capital expense of 22,660 fr. and that annual costs would be about 8,062 fr. An average crop should be 3,000 kgs. of blooms.

1115. BOISCHOT, P. 633.812
 Le géranium rosat., (*Pelargonium capitatum*).
Progr. agric. vitic., 1938, 109 : 20-2.

For economic cultivation of *Pelargonium capitatum* a climate entirely without danger of frost where the thermometer does not fall below 4° or 5° C. is essential. Under such circumstances growth is continuous and the stocks will last several years. In the neighbourhood of Grasse in Southern France it is necessary to replant each year with rooted cuttings. These are taken in the previous year and should be about 5 mm. in diameter at the bottom end and 25-30 cm. long. They are set out in May at 0.80×0.80 m. or 1.00×0.80 m. apart and are given protection in the winter. The beds, which are to receive the rooted cuttings are worked in the autumn to a depth of 30-40 cm. and manure at the rate of 40,000 kg. per hectare is ploughed in. Planting takes place in April after harrowing and rolling. Harvesting is done in August and September, in the evening to prevent the leaves drying out. Production averages in the Grasse district, about 40,000 kg. of green stuff per hectare, from which 40 kgs. of essential oil will be extracted. Notes of costs are given.

1116. ORCHARD, O. B., READ, W. H., AND SPEYER, E. R. 635.937.34 : 632.73
Animal pests. I. Rose thrips.
Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 59-62.

An account is given of a large number of trials made in the hope of controlling the thrips pest of roses, *Thrips fuscipennis*. They include poison baits, dusting, fumigation and spraying. Experiments are now in progress on the control of the insect at a time when the main exodus from winter quarters appears to take place, i.e. about the end of February. The treatment consists of spraying with 2 lb. derris or pyrethrum powder and 10 lb. potash soft soap to 100 gallons water at 4 day intervals.

1117. FOSTER, W. R. 635.939.516 : 632.452
Control of snapdragon rust (*Puccinia Antirrhini* D. and W.).
Sci. Agric., 1938, 18 : 524-6, bibl. 5.

The sprays used by the author in British Columbia included some 6 or 7 copper sprays and lime sulphur plus spreaders. The copper sprays proved best, bordeaux 4-4-40 plus spreader proved an effective preventive for snapdragons grown for seed. In the two years of the experiment two applications sufficed. Four copper sprays plus agrol 2 spreader gave enough protection from rust in snapdragons grown for seed to warrant their trial on ornamental snapdragons. They were Bouisol 1 pint to 10 gallons water, Bordinette 1 lb. to 10 gallons water, copper hydro 1 lb. to 10 gallons water and burgundy mixture 4-5-40.

1118. CHOUARD, P. 635.939.98 : 612.014.44
 La culture retardée des chrysanthèmes par la lumière d'appoint—premières recherches expérimentales et présentation de chrysanthèmes fleuris.
 (Retardation of the blooming of chrysanthemums by means of artificial light—
 the first flowers so produced.)
C.R. Acad. Agric. Fr., 1938, 24 : 312-7, bibl. 2.

The author notes that although covering buds of chrysanthemums has been successful in inducing early flowering the production of chrysanthemums at the height of the dahlia season has little to commend it. He determined, therefore, to try whether by exposure to additional light he could retard flowering and so produce chrysanthemums at a time when flowers are more in demand. Berthe-Lachaux chrysanthemums cultivated as single blooms were exposed each night from

7 September, 1937, to the light from 25-60 watt lamps, so the tops of their stems received, some 40 lux, others 175 lux. It was so arranged that some in each lot were exposed to light (i.e. daylight and artificial) for 20 hours in every 24 and that others were exposed for 16 hours in all. The plants were first treated in the open, but were later removed to the cold frame. Lighting ceased as from 25 December. The control, untreated plants, flowered normally in December, but the others did not flower until the end of February, thus showing a retardation of two months. The retardation was about the same in all cases, but certain deformations were noticeable in the flowers of those exposed to the 20 hours light and the best quality flowers were from 16 hour exposed plants. Other noticeable features were first that the stalks were particularly long and firm and secondly that the shape and form of the florets was altered so that the form of the Berthe-Lachaux flowers from the treated plants resembled that of Chrysanthemiste Lochot.

1119. MANNING, D., AND GREGORY, P. H. 635.966 : 635.944 : 635.936.751
The production of anemones for cut bloom in southern France.
J. Minist. Agric., Lond., 1938, **45** : 117-24.

In this article the author discusses methods used in southern France for the production of anemones as cut flowers. Notes are given on climate, soils, source of corms, seed saving, sowing, planting, cultivation, fertilizers, the use of lights, mats and mulches as well as grading, bunching, marketing, packing and transport. The methods described differ in many respects from those followed in this country, the points of difference, however, not being necessarily due to the difference between climatic conditions in the two countries.

1120. LUYTEN, I., AND VAN WAVERN, J. 585.724 : 635.944
 De orgaanvorming van *Leucojum aestivum* L. (**Organ formation of summer snowflake.**) [English summary 2 pp.]
Med. LandbHoogesch. Wageningen, 1938, deel **42**, verhandeling 1, pp. 31, bibl. 10.

The anatomy of *Leucojum aestivum* L. bulb is described and illustrated. An English explanation of the text-figures and plates is given.

1121. SEALE HAYNE, DEP. PLANT PATHOLOGY. 635.944 : 632.6/7
The dates of hot water treatment of narcissus bulbs. and The handling of bulbs after hot water treatment.
Fourteenth annu. Rep. Seale Hayne agric. Coll. Dep. Plant Path. for year ending 30 Sept., 1937, 1938, pp. 25-32, and 33-5, issued as *Pamphlet 48*.

The particular advice given in these articles on hot water treatment of narcissus bulbs for eel-worm is applicable to conditions in Devon and Cornwall, but the account of the principles involved should be helpful to other bulb growers. The nature and amount of flower damage done by hot water treatment varies according to the date of treatment. Generally speaking—under local conditions—treatment early in the season, say July, causes severe splitting of the trumpet or corona but does not reduce size of crop. Treatment too late, say in September, or October, leads to a reduced crop due to blind bulbs of bulbs making blind buds. In between is a short, happy period when no damage at all is done by treatment. The reason for these harmful results of hot water treatment can be found in the processes which are taking place in the bulb. The flower bud starts to form in the bulb in May and its differentiation goes on during May, June and July, by which time the different parts of the flower have been formed. The corona is one of the last parts to be laid down and hot water treatment applied before it is quite complete produces the severe splitting mentioned. The dormancy period begins only when flower differentiation is complete and this coincides with the safe period. Soon afterwards the flower bud begins to elongate inside the bulb, the scales which will become the enclosing leaves are also growing, and new roots are forming. Hot water treatment again becomes very dangerous, this time affecting the roots and often killing the bud outright. If bulbs thus rendered blind are cut open, the shrivelled brown remains of the dead bud can usually be seen. The actual safe period differs not only with variety but also with district and to a much smaller degree with season. The varying results of treating in or out of the safe period are considered for 9 classes of narcissus.

The second article gives practical hints on after-treatment, the bare gist of which is as follows :—
(1) Use trays rather than sacks since they retain the heat less after removal from water and allow bulbs to dry more quickly, so avoiding fungal attack. (2) After late treatments it would not appear to matter whether slow or rapid cooling (immersion in cold water) is done, but after early treatment the omission of the cold water dip seems advisable. (3) If possible bulbs should not be planted while still wet just after treatment. If this must be done they should previously be dipped in a fungicide not already used in the bath.

1122. GUBA, E. F., AND GILGUT, C. J. 635.938.46 : 632.651.3

Control of the begonia leaf-blight nematode.

Bull. Mass. agric. Exp. Sta. **348**, 1938, pp. 12, bibl. 13.

Sanitary and cultural methods within the limits of good plant growth and commercial practice are not effective in arresting the progress of the begonia disease, caused by *Aphelenchus olesistus* Ritzema-Bos. Propagating from stock free of the nematode disease is the best method of control. Further, the following treatments are recommended for both healthy and infested begonia plants and leaf-cuttings :—submersion of plants in hot water at temperatures of 121-120° F. for 1 minute, 119° to 117° F. for 2 minutes, or 118° to 115° F. for 3 minutes. It is advisable to try the treatments on a few plants before applying them on a large scale. The plants should be treated at least 3 months before the marketing season (small plants still earlier in the season, i.e. when an infestation first becomes noticeable) in order to give them time to develop good foliage.

1123. OYLER, E. 632.48 : 635.939.98

***Verticillium* wilt of chrysanthemums.**

Annu. Rep. Exp. Res. Sta. Cheshunt 1937, 1938, pp. 48-9.

OYLER, E.

635.939.124 : 632.411

***Phytophthora* wilt of heaths.**

Ibidem, pp. 49-50.

OYLER, E.

635.939.98 : 632.4

A leaf spot of marguerites (*Ramularia bellunensis* Speg.).

Ibidem, pp. 50-2.

and

WHITE, H. L.

635.936.69 : 632.48

Anther smut of the perpetual flowering carnation.

Ibidem, pp. 52.

IMAI, Y.

635.936.69

Sports of perpetual carnations.

J. Coll. Agric. Tokyo, 1936, **14**, 1-10.

Abstracted in English (4 lines) in *Jap. J. Bot.*, 1937, Vol. **9**, No. 1, abstr. 33.

KARASAWA, K.

585.79 : 635.944

Karyological studies in *Crocus* L.

Jap. J. Bot., 1937, **9**: 1-15, bibl. 6.

CITRUS AND SUB-TROPICALS.*

1124. TANAKA, T. 587.519 + 634.3

Further revision of *Rutaceae-Aurantioidiae* of India and Ceylon. (Revisio

Aurantiacearum VIII.) [Japanese-English summary.]

J. Ind. bot. Soc., 1937, **16**: 227-40, being *Contr. hort. Inst. Taihoku imp.*

Univ. **21**.

As the result of the author's visit to India and Ceylon in 1935/36 he here lists some 110 species, sub-species or varieties of the *Rutaceae-Aurantioidiae* found in different localities, with notes as to distribution, and with botanical description (in Latin) where this has not been given previously.

* See also 942, 1032.

1125. TANAKA, T. 587.519 + 634.3
On Indian citrus fruits. [Japanese-English summary.]
 Reprinted from *Nettai Engei* 1937, Vol. 7, No. 1, pp. 12, being *Comm. hort.*
Inst. Taihoku imp. Univ. 64.

The author notes that the vast number of citrus presented in Bonavia's work mostly came from the Ganges region from Assam to the North West Provinces and that this region still has a number of wild species not yet fully brought into cultivation. He identifies Bonavia's Santara as the Ponkan (*C. chrysocarpa* Lush.), his Keonla as *C. crenatifolia* Lush., his Khatta as a *Citrophorum* (*C. Karna* Raf.) and his Jambhiri as the Florida Rough [rough lemon—ED.] (*C. Jambhiri* Lush.). The sweet lemon is found by the author to be not the European *C. Limetta*, Rosso, but an acidless citrus related to the large fruited *Limonia*, named *C. limettioides* Tanaka.

1126. TANAKA, T. 634.3
On certain sub-tropical citrus fruits. [Japanese, English summary 6 lines.]
 Reprinted from *Studia Citrologica*, 1937, 8: 68-84, bibl. 12, being *Comm. hort. Inst. Taihoku imp. Univ.* 57.

In this publication descriptions and coloured illustrations are given of the Mosambi of India, *Citrus sinensis* Osbeck var. *rugoso-dulcis* var. nov.; the Chota Kitchlee of India, *Citrus Reshni* Hort. var. *canaliculata* var. nov.; and the Yuhikitsu (Taohung Kieh) of Formosa and South China, *Citrus oleocarpa* Hort. ex Tanaka sp. nov.

1127. MAKAROV, D. D. 634.323
Grapefruit as a commercial crop. [Russian, English summary 16 lines.]
Soviet Subtropics, 1938, No. 5 (45), pp. 93-8.

Tests of grapefruit varieties carried out at the Sukhum Introduction Nursery showed that the grapefruit is well adapted to the conditions of the Soviet humid subtropics. The characteristics of varieties showing particular promise are discussed.

1128. TAVBERIDZE, I. 634.322-1.55
Control of periodicity in mandarin fruiting. [Russian, English summary 14 lines.]
Soviet Subtropics, 1938, No. 5 (45), pp. 84-6.

Periodicity in mandarin fruiting has been studied for some time at the Batum Botanical Garden. As a result pruning is recommended as the principal method for its control. Blossom and fruit thinning are regarded as ineffective. When pruning, an approximate relationship of 10 : 1 between the old and new foliage should be aimed at.

1129. PACHEV, A. G. 634.322 : 581.162.5
Unshiu mandarin pollen viability. [Russian, English summary 7 lines.]
Soviet Subtropics, 1938, No. 6 (46), pp. 31-6.

Experiments carried out for several years at the Sochi Research Station show that, contrary to common opinion, the Unshiu mandarin, under certain conditions, may possess a large quantity of viable pollen. Certain interesting cases of multiple pollen formation in the Unshiu mandarin blossom are noted. Trials made with pollen in 20% sugar solution show that 10.3-11.3% of Unshiu pollen grains are viable.

1130. ESINOVSKAYA, V. 634.334
The best lemons from the Black Sea Coast. [Russian, English summary 11 lines.]
Soviet Subtropics, 1938, No. 5 (45), pp. 44-8.

In 1933-35 lemon tree forms were studied by the U.S.S.R. Institute of Tea Industry and Subtropic Plantation Crops along the Black Sea coast over the whole area from Sochi to the Turkish frontier. The better forms found in Abkhazia (7 forms), Ajaria (4 forms) and Western Georgia (3 forms) are here described briefly.

1131. KALICHAVA, A. D. 634.334 : 581.13
Biological peculiarities of the lemon tree. [Russian, English summary
 14 lines.]
Soviet Subtropics, 1938, No. 8-9, pp. 26-30.

The biological peculiarities of lemon trees are considered in the light of recent findings. In the humid subtropics of U.S.S.R. lemon trees are said not to pass through a normal dormant stage in winter. There the autumn period is extended and in the absence of frost the plants produce new shoots, buds and fruit. As a result observations of the last ten years have shown that even branches of one and the same tree may undergo different phases of development. Records made at the Sochi Research Station in 1932-3 show that the lemon flowers and ripens earlier than the tangerine and orange. Other data (Sukhum Research Station and Batum Botanical Garden) show great differences in the phases of flower development between different varieties and between different forms of citrus.

1132. SHANIDZE, V. M. 634.334 : 575.252
A seedless lemon variety. [Russian, English summary 7 lines.]
Soviet Subtropics, 1938, No. 8-9, pp. 46-7.

A seedless lemon bud mutation occurring in Ajaria has been investigated. The tree budded with it yielded some 1,200 seedless fruits in 1936 and 1,500 in 1937. Its points awarded on the 100 point system used in the U.S.A. are here recorded.

1133. RUGGIERI, G. 634.334
 Indagini sulla varietà di limone "Monachello". (Investigations on the
Monachello lemon.)
Boll. Staz. Pat. veg. Roma, 1937, 17 : 293-304.

As stated in another place (see abstract 1134) growers in Sicily have of late tended to replant lemon groves brought low by the ravages of malsecco with the Monachello variety of lemon. Slowness to grow and produce suggests the necessity for double working and it is hoped that the use of sweet orange as an intermediate may have a salutary effect on these two characters. From the present article it would appear, however, that there are several strains of the variety and that some of these strains are by no means resistant to malsecco.

1134. RUGGIERI, G. 634.334-1.541.11
 Ricerche sull'affinità d'innesto del limone "Monachello" con altri citrus.
 (Investigations on the compatibility of the **Monachello lemon with other citrus.**)
Boll. Staz. Pat. veg. Roma, 1937, 17 : 79-86.

Owing to its resistance to *Deuterophoma tracheiphila* the Monachello variety of lemon has been extensively used, worked on sour orange, for the reconstitution of lemon groves falling out of cultivation owing to the ravages of malsecco. It has, however, been found to grow rather slowly and to produce irregularly and scantily in comparison with other lemons. Observations by the author have shown that it is incompatible with sour orange and with lemon but compatible with mandarin and sweet orange. The recommendation is therefore made that in re-establishing lemon groves with the variety Monachello, it should be double worked on sweet orange and sour orange, the latter forming the rootstock.

1135. ROBOTHAM, C. M. A. 634.332-1.541.5
Budding of limes.
J. Jamaica agric. Soc., 1937, 41 : 633.

Factors for success in budding limes on to sour orange stock in Jamaica lie in the proper selection of budwood and the duration of the period prior to unloosening the tie. The most successful budwood is obtained from ripe wood of the past season's growth, and the buds thereon should have swollen and be on the point of bursting. After budding the buds tend to lift from the

stock at the bottom or sides of the incision, in many cases even when the tie is kept on for more than a month. The use of raffia as a tie is suggested since this can, if necessary, be left on until it breaks through weathering, thereby allowing time for a strong union to be effected.

1136. HODGSON, R. W. 634.3-1.541.11 : 581.192
Rootstock influence on the composition of citrus fruits.
Calif. Citrogr., 1938, 23 : 499, 531, bibl. 5.

The following stock effects have been noted from the rootstock trials of the University of California at Los Angeles. (1) Trifoliolate orange, the most dwarfing rootstock used, has produced the highest soluble solids content in the juice of the Valencia and Washington Navel oranges, Eureka and Lisbon lemons, Bearss lime and Marsh grapefruit; rough lemon, the most vigorous rootstock, has given the lowest soluble solids content. (2) Rough lemon has produced the lowest acid content; trifoliolate has a marked tendency to produce high acid content. Trifoliolate orange and rough lemon, as rootstocks, have been approximately equally effective in producing high soluble solids-acid ratios in the juice of the fruit.

1137. HODGSON, R. W., EGGERS, E. R., AND CAMERON, S. H. 634.334-1.541.11
On the relation between vigor of scion variety and rootstock reaction in the lemon.
Calif. Citrogr., 1938, 23 : 290, 306, bibl. 5.

From data obtained from rootstock trials in progress at the University of California the following tentative conclusions for lemons are put forward: (1) An important relation exists between scion variety vigour and rootstock reaction in the lemon. (2) Of the four commercial rootstocks under experiment, sweet and sour oranges, grapefruit and rough lemon, sour orange gives the poorest and sweet orange the best results with Eureka lemon, while for Lisbon lemon no significant difference was obtained between any of these stocks. In these experiments data were obtained over 3 years of areas of trunk cross sections and of yields.

1138. MORRIS, A. A. 634.3-1.8
The effect of differential fertilizer treatments on the yield and quality of fruit from mature bearing Valencia Late trees on Mazoe Citrus Estate, Southern Rhodesia.
Annu. Rep. Mazoe Citrus Exp. Sta. for 1936, being *Publ. S. Afr. Co.* 6, 1937, pp. 109-53, bibl. 12.

The author's report of work carried out during the years 1932-6 is in four parts. (1) *Field and packhouse data.* The fertilizer and field practices both prior to and during the experiment are recorded. Results to date show that nitrogen plays the most important part in maintaining tree vigour, high production and good coloured fruit. Phosphorus helps to set heavy blossom and to improve juice percentage and soluble solids; acid ratio in mature fruit. Potash has given rise to somewhat increased percentages of acid in the fruit and hence a lowering of soluble solids; acid ratio. No treatment affected the fruit size of the bulk of the crop. A low nitrogen status increased susceptibility of the fruit to fumigation burn and rind spot. (2) *Laboratory data.* Analytical and sampling methods are noted. The changes in availability of potash and phosphate according to treatments given are discussed. The interpretation of soil analysis in relation to citrus fertilizer needs is considered in the light of known tree response to treatment. The estimation of total nitrogen content of soils is found to be an unsatisfactory method of assessing true nitrogen status of soils in relation to thrifty citrus growth. (3) *The determination of the nutrient requirements of citrus trees by the indirect method of analysis of plant material.* This part deals with results obtained in analysis of fruit and leaf material. Methods are discussed. The intake relationships of NPK and Ca are interpreted by values from each grove. They appear to be N direct with K and reciprocal with P and Ca. The conclusion is reached that the analysis of N in juice and peel might serve as a valid means of estimating N requirements of citrus trees. The estimation of P, K and Ca by such methods is not so satisfactory. (4) *Deterioration of citrus trees at Mazoe in part related to irrigation.* Nitrogen and boron soil deficiencies were

investigated with reference to loss of vigour and fruit produced. Boron deficiency symptoms vary with degree of deficiency, with variety and with time of year. Valencia Late budded to Mazoe rough lemon is most susceptible, owing, in the author's opinion, to the vigour and high production of this variety at Mazoe, while Washington Navel on the same stock is least susceptible. Among symptoms noted are abnormal wilting and fruit drop, gumming and arrested development of fruits, restriction of new growth and marked dieback, and a condition resembling exanthema as described by Haas and Klotz, *Hilgardia* 1931, 5 : 175-97, *H.A.*, 1 : 267.

1139. HOSKINS, W. M. 546.23 : 634.3 + 634.8
The absorption of selenium by citrus and grapes.
Science, 1938, 87 : 46-7.

The results are given of analyses of citrus fruits and grapes from plots which for several years had been treated with selenium dissolved in potassium ammonium sulphide for the control of red spider. The dilution used was 1-800 on citrus and 1-600 on grapes. The conclusion is reached that neither citrus trees nor vines concentrate large amounts of selenium as the result of spraying. Thus the actual amounts of Se found on sprayed citrus fruits were 0.21 p.p.m. (skin) and 0.06 p.p.m. (pulp) as against 0.10 p.p.m. and 0.05 p.p.m. in unsprayed fruits. A complete account of the work is said to be in process of compilation at the Californian Agricultural Experiment Station.

1140. OPPENHEIMER, H. R., AND MENDEL, K. 634.332/3-1.83
Problems of citrus nutrition. II. Studies on the potash requirements of sweet lime.*
Hadar, 1938, 11 : 177-81, 244-9, bibl. 16.

The data are derived from sweet lime rooted cuttings grown in sand irrigated with modifications of Hoagland's solution containing potassium in concentrations between 0 to 740 mg. per litre. The plants receiving the maximum amount of potassium were badly injured or killed while those receiving 11.6 p.p.m. (a total for the experiment of 29 mg. per tree) or less showed the usual signs of potash deficiency. The best growth was obtained from trees receiving 46 p.p.m. K (115 mg. per tree total). The same optimum curve as for potassium application was established for the use of water and for the absorptive power of the roots for nutrient salts as reflected in the osmotic concentration of the percolates. Microchemical tests of leaves and ash analysis both showed clearly that the absorption of K had increased with increasing concentrations in the medium. The Ca content of the ash was lower in trees receiving excess potassium than in those under a more normal K : Ca balance. In the former case it sank to 12% or less than one-third of the K content, but under a moderate K deficiency it rose to 44.9% or ten times the K content. There was no increase in absorption with rising concentration in the medium. The plants absorbed bound potassium from minerals present in the purified sand in minute proportions, such absorption being more extensive with moderate than with pronounced lack of soluble potassium.

1141. CHAPMAN, H. D. 634.3-1.8
Citrus fertilization questions.
Calif. Citrogr., 1938, 23 : 287, 326-7, 332, 361-3.

In citrus orchards in California 2 or 3 lb. of nitrogen per tree are usually required. If bulky organic materials are used, sufficient of the quickly available forms should be added at the time of application to bring the nitrogen-organic matter ratio up to 1:20. The regular use of bulky organic material at the rate of 4,000-6,000 lb. per acre is recommended. No other essential plant food element except zinc appears to be lacking from Californian citrus soils. The absence of zinc will be indicated by the appearance of mottle leaf and can be cured by zinc sprays. Sulphur or gypsum need only be used in soils of high alkalinity (above 8.5 pH) or on soils of poor tilth resulting in slow water penetration. There exists some theoretical justification for

* I. *Ibidem* 1934, 7 : 268-71, 1935, 8 : 14-7, *H.A.*, 5 : 261.

the suggestion that with moderately alkaline soils having pH values above 7.5 a movement towards neutrality or slight acidity might produce conditions in the root zone more favourable for the availability of certain essential plant food elements.

1142. ROY, W. R. 634.31 : 581.192 : 631.811.9

The effect of soil applications of manganese on the mineral composition of foliage and maturity of fruit in citrus.

Proc. Fla. St. hort. Soc. for 1937, pp. 29-37, bibl. 6.

In experiments with Parson Brown oranges on an acid sand soil in Florida, base-forming fertilizers and manganese, used in conjunction with acid-forming fertilizers caused a slight decrease in the calcium content of the leaves. Soil applications of manganese increased the manganese content of the leaves throughout the season, the increase being noticeable within 2 weeks after application. Formation of sugar was also accelerated, the fruit rind took on a more intense colour and juice, and firmness and weight increased.

1143. KLYUSHNIKOVA, M. I. 634.334-1.811.91

Water requirements of lemon trees. [Russian, English summary 15 lines.]

Soviet Subtropics, 1938, No. 5 (45), pp. 90-2, bibl. 12.

Water requirements of lemon trees have been studied for some time at Sochi (U.S.S.R.). The author reached the following conclusions. Lemon trees in pots always wilt in soils with a moisture content equal to 150% of their maximum hygroscopic capacity. Thus, the process of wilting depends entirely on the hydrological properties of the soil. Soils used in the present study (a mixture of humus, sand and sods) had a maximum hygroscopic capacity of 10.11% and their water-holding capacity corresponded to 60% of the moisture content. On these soils lemon trees started wilting when soil humidity reached 15.9%, but the plants were not killed even when soil moisture was reduced to 2.42%. Lemon trees were found to be capable of undergoing a very prolonged wilting and yet keeping all their leaves alive. In this experiment they proved able to stand a soil moisture of 5% for over a month without being seriously affected. Young leaves were found more resistant to drought than old leaves. In Sochi 2½-year-old lemon trees evaporate yearly some 30 litres under approximately optimum soil moisture conditions.

1144. OPPENHEIMER, H. R. 634.334

How to produce summer lemons in Palestine.

Hadar, 1938, 11 : 231-2, 244.

Experiments have been made in Palestine in the forcing of lemons for the production of summer fruit, the usual time of maturity being from November to March. The method adopted is one well established in Sicily, by which the trees are wilted for a time by withholding irrigation and then subjected to irrigations, chemical manure, mainly nitrogen, being added to the water. Points noted during the Palestine experiments are a great variation between trees in degree of wilting, and a marked inverse ratio between degree of wilting and number of fruit. It was found that Palestine fruit so treated ripened in 8-9 months instead of the 12-13 required in Sicily. The wilting period, therefore, to procure fruit the following summer, should be from early August to mid-September. The experiments are being continued in commercial groves.

1145. BLANCHARD, V. F. 634.334-2.183

Effects of coastal winds on growth and yield of lemon trees.

Calif. Citrogr., 1938, 23 : 438-9.

The value of windbreaks for lemon groves in the coastal districts of California is emphasized by records of an examination of comparable 3-year-old trees in adjacent protected and unprotected sites. 100 trees in each situation were recorded. The protected trees averaged 122.8 fruits per tree and 12.88 inches circumference 2 inches above bud union, the unprotected trees averaging 24 fruits and 6.08 inches.

1146. WAHLBERG, H. E.

631.67 : 632.183 : 634.3

Plan irrigation to reduce wind injury.*Calif. Citrogr.*, 1938, 24 : 11.

Excessive irrigation in the spring and early summer is one of the greatest contributory causes to wind injury in California. What is required is a conservative application in the spring months to allow of fluctuation of moisture content, and an ample supply of moisture in the autumn months when the dry winds are prevalent. A decided correlation has been found between wind injury and soil moisture content at this time. Trees well above wilting point in recent investigations in comparable citrus orchards showed no wind injury while those reaching or below wilting point suffered in proportion to the dryness of the soil. It is suggested, not that soil moisture control will prevent wind injury or supersede the intelligent use of windbreaks, but that it will substantially reduce the amount of injury.

1147. WALKER, H. B.

634.3-2.111

Orchard heater investigations.*Calif. Citrogr.*, 1938, 24 : 3, 20-2.

Four general types of orchard heater are discussed and their methods of functioning explained. (1) Generating, (2) distilling, (3) atomizing, (4) drip. The generating heater will burn without excessive smoking if provided with a relatively high quality (and therefore expensive) oil. Distilling heaters are used more than any other type. They are of two types (a) the lazy flame and (b) the combustion chamber type. These heaters are very sensitive and for clean combustion require better temperature regulation than can be obtained in the field. For this reason they are nearly all smoke producers and no matter how well operated all present a troublesome fuel residue problem. Research for improvements to this type of heater is directed to the "return gas" principle, by which a portion of the stack gases are recirculated back into the bowl. The inert character of these gases is effective in preventing the coagulation of the atomic carbon so that practically complete combustion occurs during exposure to the flame, leading to a cleaner combustion and less smokiness. All distilling heaters have a tendency to reduce their burning rate with the lowering of the fuel. Atomizing heaters are at present only used experimentally and are of the pipe-line type. Oil and air are injected into the pipe line in such ratios of air to oil as will set up velocity differentials between the air and oil sufficient to carry the oil to the burners and at the same time deliver sufficient air to atomize the fuel at the burner nozzle. Potentially such heaters should be relatively easy to light and to extinguish, should operate without troublesome soot or coke accumulations in the burners and should create no pourback problems. The plant required for, say 10 acres, would be a fuel tank, an air compressor and an engine to drive it, and an oil feeder line and an air feeder line from which a series of pipe line loops would lead out into the orchard to serve a series of heaters on each loop. A poorer than average fuel could be used. Drip heaters for orchard use with the poorer grade fuels have not been successful; with better than average fuel they are tolerably efficient.

1148. FAWCETT, H. S.

634.3-2.8

Development of psorosis (scaly bark) in relation to origin and history of various citrus varieties.*Calif. Citrogr.*, 1938, 24 : 6, 30-2; bibl. 6.

Psorosis or scaly bark is now attributed to a virus that owes its transmission mainly to the practice of budding. Observations to date indicate that (1) the virus is systemic throughout the whole of an infected tree; (2) there are several strains which produce similar symptoms on the leaves and somewhat different ones on the bark; (3) there are different degrees of virulence; (4) differences exist between varieties of tolerance to the effects of the disease. The author endeavours to trace the origin of the disease in California in the different citrus varieties and concludes that none of the original varieties such as Navel and Valencia orange or Eureka and Lisbon lemon, came to California with the virus in them but that it existed in some inferior varieties which were ultimately topworked with the commercial sorts, which thus became infected and so spread the disease by means of their scion wood. It is considered that by the intensification of methods already undertaken voluntarily by many commercial propagators, namely

propagation only from trees of known parentage free from psorosis, the disease in a generation may be so reduced that a campaign of eradication would then definitely free California from this serious handicap.

1149. RHODAS, A. S. 634.3-2.19

Observations on psorosis of citrus in Florida.

Proc. Fla St. hort. Soc. for 1937, 1938, pp. 46-53, bibl. 7.

The gumming disease of citrus known as psorosis is described. In Florida the most simple and effective method of control is bark scraping in which sufficient bark is taken off to remove the outside dark coloured surface, i.e. to about one-third of the bark thickness. This operation should be immediately followed by a lime sulphur wash. (In California with its different climate the wash precedes the scraping.) The wash should not be strong enough to cause injury. If lime sulphur solution is used, one part in 6 to 8 of water is strong enough.

1150. BAHRT, G. M., AND HUGHES, A. E. 634.3-2.19

Soil fertility and experiments on bronzing of citrus.

Proc. Fla St. hort. Soc. for 1937, 1938, pp. 23-8.

The bronzing of citrus leaves in Florida is a form of chlorosis which greatly reduces the number of leaves per branch, shortens the life of the leaf by about one-third and reduces yield. As bronzing advances the magnesium contents of the leaf decreases and the calcium/magnesium ratio increases. A number of experimental treatments are described of which the most promising treatments are applications of any of the following in addition to complete fertilizer:—calcined kieserite, dolomitic limestone, manganese sulphate, and ground calcium limestone supplemented by magnesium sulphate.

1151. EBELING, W., KLOTZ, L. J., AND PARKER, E. R. 634.31-2.19

Experiments on navel waterspot.

Calif. Citrogr., 1938, 23 : 410, 434-6.

Water spot is a physiological disease of mature oranges caused by wet climatic conditions and therefore in California affecting only Navels which mature during the wet months of January or February. Symptoms are a minute cracking of the cuticle, usually near the navel, caused by the swelling of the underlying tissue when it absorbs water. The affected parts swell with continued wet weather and assume a watersoaked appearance. If the wet weather continues fungi enter the wound and cause rotting, while if dry weather comes the water soaked areas develop a dry, hard, brown and somewhat depressed surface. In a recent survey oil sprays were found greatly to accentuate the injury though any differences in the effect of the various types of spray oil were not statistically apparent. Groves on the other hand which were sprayed with miscible oil and lime sulphur and most fumigated groves were practically free from water spot. Ammonium polysulphide may be substituted for lime sulphur with equally good results as regards absence of water spot. The comparative insecticidal value of the two was not examined. Certain supplementary treatments, lime-sulphur, zinc-lime, zinc-copper-lime and zinc-soda ash, applied because of strong rumours of their efficacy in reducing water spot, had no significant effect. A coating of 2% wax emulsion had considerable protective but no insecticidal value, and the expense of its use is scarcely warranted.

1152. MOREIRA, S., with a note by REICHERT, J., AND PERLBERGER, J. 634.3-2.19

Xyloporosis.*

Hadar, 1938, 11 : 234-7, bibl. 16.

The citrus disease which has of late years appeared in Palestine, causing die-back and bark injury, especially to Jaffa oranges budded on sweet lime, and has been provisionally named xyloporosis by its local investigators, is thought by Moreira, from similar developments which have occurred in Brazil, to be merely a symptom of incompatibility between stock and scion. Reasons for this deduction are given, the main argument being the rapid recovery of the affected scion when transferred by inarching to a congenial stock. Reichert and Perlberger, who have

* See also *Ibidem* 1936, 9 : 71-4, *H.A.* 1936, 6 : 366.

investigated the disease with some care in Palestine, have appended a note in which they deny that xyloporosis can be considered a primary cause since symptoms appear also in unbudded trees, but they think that the degree of compatibility can certainly influence the appearance of the disease and that the origins of the disease are due to some complex of physiological factors not yet fully elucidated. These last workers are preparing a paper containing further data.

1153. PARKER, E. R. 634.3-2.19
Progress in mottle leaf control.
Calif. Citrogr., 1938, 23 : 334, 367, 392-3.

Citrus trees will respond to zinc treatment in proportion to the severity of the symptoms of mottle leaf. If no symptoms are evident there will be little or no response in increased yields. Severely affected trees should be sprayed, this method of application having proved the most effective for mottle leaf. The zinc materials should be present at a concentration equivalent to 1·15 lb. zinc per 100 gallons water. This concentration is effective at all seasons, the effect lasting about 2-3 years. Zinc sulphate and oxide are the most practical and economical salts. Zinc sulphate must be combined with a precipitating chemical such as lime and soda ash. A mist spray should be used. It does not seem to be necessary to incorporate a spreader in the mixture. Combination sprays are possible. Zinc oxide can be incorporated with lime-sulphur, but the use of zinc with oil sprays leads to different reactions among the various oils and the specific recommendations of the manufacturer should be incorporated. Dusts are only useful in maintenance treatment of slightly affected trees.

1154. MORRIS, A. A. 546.27 : 634.31-2.19
Some observations on the effects of boron treatment in the control of "hard fruit" in citrus.
J. Pomol., 1938, 16 : 167-81, bibl. 10.

The experiments described here were carried out on 16-18-year-old Valencia Late orange trees between 1935 and 1937 in Southern Rhodesia. The analytical methods used are recorded in an appendix and the experimental and sampling methods are discussed in the paper. The author summarizes as follows: "... analyses show that the boron content in fruits is increased by boron treatment and that 'hard fruit' symptoms are associated with a low content of this element. It is also shown that with the possible exception of nitrogen, the intake of the more common nutrient elements by the young citrus fruit does not appear to be influenced by boron treatment. On the other hand it is found that sugars and pectins are lower in boron deficient fruit than in fruit from trees under relatively low boron treatment. Under high boron treatment, however, there is some evidence that the sugars, but not the pectins, are retarded rather than stimulated in their translocation to the fruit. The analysis of leaves shows that boron treatment is early reflected in an enhanced boron content on the leaf at an early stage of growth and that boron accumulates in the leaf with increasing age. As with fruit, leaves from 'hard fruit' trees are found to be very low in boron. Analyses of twenty-one samples of leaves picked at random show that varying boron status is correlated with varying severity of 'hard fruit' incidence. Crop results from treated and control trees are given and show that severe losses of fruit are occasioned by a deficiency of boron, not only during the growing season but also subsequently in the packhouse. Maturity test data for 1937 indicate that the percentage of juice and soluble solids is increased in mature fruit by boron treatment, but that the maturing process is somewhat delayed."

1155. BATES, G. R. 634.3-2.1+2.3/4
VI. Report of the plant pathologist for the year ending December 31st, 1936,
VII. Diseases of citrus fruits in Southern Rhodesia.
Annu. Rep. Mazoe Citrus Exp. Sta. for 1936, being *Publ. S. Afr. Co.*
6, 1937, pp. 158-67, bibl. 5 and 173-208, bibl. 22.

The report of the plant pathologist contains the following notes which may be of more than local interest. The heavy wastage during the 1936 export season among the early varieties of orange is attributed to an advancement of 6 weeks in the picking season. Similar Jaffa oranges picked

late in an adjoining orchard showed little wastage and carried far better under more trying conditions. A study of latent infection on the rinds of oranges is in progress. No latent infections were found on very young fruits up to 1.3 cm. diameter and 1.5 grammes in weight. Oranges of 20 grammes weight had occasional latent infections of *Alternaria Citri* in the rind tissues below the calyx and in 40% of the buttons of these fruits. 90% of oranges of 49.1 grammes contained latent infections of *Colletotrichum gloeosporioides*, about 9% had latent infections of *Alternaria Citri* and *Glomerella cingulata*. Experiments in low temperature injury in storage at 40° F. in relation to fertilizer treatment showed that the greatest amount of cold injury developed on oranges from groups of trees at the top of the grove and least from those at the bottom. It may possibly be associated with excessive leaching of important soluble plant food at the start of the irrigation beds. Fruit with the lowest nitrogen content in the peel exhibited most cold injury. In general cold injury in apparent relation to fertilizer occurred in descending order as follows: liberal phosphate, liberal potash, reduced complete fertilizer, manure only, normal complete fertilizer. Wastage influenced by fertilizer treatment or oranges stored under commercial conditions was not apparent in Jaffas, but in Valencia Late the grove receiving heavy dressings of nitrogen showed *Alternaria* rot 3 times as severe as in any other. In wrapper tests 3½% oil-treated wrappers were the strongest, most attractive and easiest to use, though giving no improvement in control of wastage over the untreated sulphite variety. Cellophane was disappointing. The second paper lists a formidable number of diseases of citrus, both parasitic and physiological, occurring in S. Rhodesia, but it is pointed out that only a very few of these are of regular occurrence or serious consequence. These are discussed at length. Special attention has been paid to citrus fruit rot in the packing house.

1156. MANDELSON, L. F., AND BLACKFORD, F. W. 632.3/4 : 634.322
Brown spot of the Emperor of Canton mandarin and its control.
Qd agric. J., 1938, 5 : 132-43, bibl. 5.

At present brown spot is apparently restricted to New South Wales and Queensland and to the Emperor of Canton mandarin only. In the former State it is one of the major citrus problems, in Queensland it is at present strictly local. The most conspicuous symptom is spotting which occurs on the rind of the fruit. Affected fruits have a tendency to fall, especially when half grown. Leaves and twigs are also affected and trees so attacked are almost continuously in growth, the tender shoots rapidly dying back and the tree as a result bearing much dead wood. The identity of the causal organism is in doubt, both *Colletotrichum gloeosporioides* and an unknown bacterial pathogen being suspect. Four applications of bordeaux mixture 3:2:40+1% red oil reduced the incidence of the disease but increased the scale population of the trees. A spray mixture of home-made colloidal copper with a copper content equal to bordeaux 3:2:40 proved effective in trials without increasing scale when 3 applications were given, at half blossom fall, when most of the fruit has set, and again in late February.

1157. REID, W. D. 634.3-2.314
Citrus-blast in New Zealand.
N.Z. J. Sci. Tech., 1938, 20 : 50A-4A, bibl. 12.

Citrus blast is a bacterial disease occurring in the main citrus growing areas of New Zealand. The causal organism resembles *Pseudomonas Syringae* van Hall in its morphology and cultural and physiological reactions. The infection is considered to be dependent on the presence of injuries to immature growth. Certain control measures are recommended based on overseas experience.

1158. REID, W. D. 634.3-2.314
Citrus canker in New Zealand.
N.Z. J. Sci. Tech., 1938, 20 : 55A-62A, bibl. 6.

Citrus canker has lately appeared in New Zealand for the first time and has been found on all varieties grown in the country. The symptoms are characterized by raised, rough, brown scabs with crater-like depressions, and dark margins on fruit and stems and both leaf surfaces. The

morphology and cultural and physical reactions of the causal organism agree with recent descriptions of *Pseudomonas Citri* Hasse. Control measures have been enforced and consist of the eradication of infected trees in small orchards and bare pole pruning plus spraying with lime sulphur in commercial orchards.

1159. BAKER, R. E. D. 632.482 : 634.3

Citrus scab disease on grapefruit in Trinidad.

Trop. Agriculture, Trin., 1938, 15 : 77-9, bibl. 5.

Citrus scab has recently appeared on grapefruit plantations in Trinidad. Hitherto grapefruit had been considered to be immune or highly resistant, at any rate in Trinidad, though in Puerto Rico and Florida scab on grapefruit is common. Inoculation and other studies point to the grapefruit scab in Trinidad and elsewhere as being a mutation from the sour orange strain, *Elsinoe Fawcettii*, and it must, therefore, now be accepted as a permanent menace. In Florida and Puerto Rico infection is reduced from 40% to less than 5% by the use of copper sprays applied at blossom time when half the petals have fallen. Leaf infections are disregarded. Cutting out and burning diseased material is an unsatisfactory control and damages the trees.

1160. STOFBERG, F. J. 632.752 : 634.3

The citrus red scale (*Aonidiella aurantii* Mask.).

Sci. Bull. Dep. Agric. S. Afr. 167 (*Bull. Plant Ind. Ser.* 24), 1937, pp. 22, bibl. 13.

An account is given of the early history of red scale, of its economic importance and introduction to South Africa. The life history of the scale and its host plants are described in full and its natural enemies noted. Control measures consisting of spraying with various oils and fumigation with liquid HCN gas and other fumigants are discussed.

1161. MCKENZIE, H. L. 632.752

Generic characteristics of *Aonidiella berlese* and *leonardi*, and a description of a new species from Australia (*Homoptera-diaspididae*).

Pan-Pacific Ent., 1937, 13 : 176-80, bibl. 5, being *Pap. Calif. agric. Exp. Sta.*, 371.

This is an illustrated description of the female of the scale, *Aonidiella eremocitri* McKenzie, n.sp. This species may be separated from other *Aonidiella* species by means of a key which is given.

1162. BOYCE, A. M., AND PRENDERGAST, D. T. 634.3-2.654.2

Control of citrus red mite (spider).

Calif. Citrogr., 1938, 23 : 370, 398-400.

A number of materials and combinations apart from the regular oil sprays have been tested against red spider of citrus (*Paratetranychus citri* McG.) at the Citrus Experiment Station, California. (1) *Low-dosage oil* ($\frac{1}{2}\%$) *plus rotenone-bearing materials*. Considered as a combined control of aphid, red spider, and off-hatch black scale these mixtures are very practical. For red-spider control alone they are expensive, since the degree of egg kill is not as good as with the full amount of oil, though the kill in all other stages is good. The control lasts 3 months. (2) *Miscible oil-lime sulphur*. This combination can be used only during late autumn and early winter and will control spider till the following summer or autumn. It is of value if red spider does not become important until November, and unlike other oil sprays it does not predispose the fruit to water rot. Climatic conditions, however, may cause its use to be attended with considerable hazard. (3) *Lime sulphur-wettable sulphur*. 2% lime sulphur fortified with 3-5 lb. wettable sulphur will effect satisfactory control for about 6 weeks. Its limitations are in regard to injury in relation to high temperatures, low relative humidity and winds. (4) *Lime sulphur-iron sulphate*. None of the lime sulphur-sulphate mixtures have proved satisfactory for red spider control or safe enough on the fruit for general use. (5) *Ammonium polysulphide*. In experimental work this proved more effective than lime sulphur in spider control and safer under high temperature conditions. Its effectiveness, for reasons not known, seems to be diminished

under commercial conditions. Control should last two to three months. Performance is improved when $\frac{1}{3}\%$ light-medium oil is combined. (6) *Sulphur dust*. After repeated trials with most of the readily available types of sulphur dust it is recorded that sulphur dusts are unreliable for general use in the control of red spider. (7) *Dinitro-ortho-cyclo-hexyl-phenol*. In experimental work over 300 acres a 1% concentration in a suitable carrier such as walnut shell flour (a convenient local by-product in California) has given promise. The chemical is not volatile at orchard temperatures, hence a thorough coverage is necessary to contact all mites. Special equipment is necessary and has been made to reach the under sides of the leaves. Two thorough and timely applications at 10 day intervals afford control for six months. Regular dusting may be incorporated in the dinitro mixture for use as against citrus thrips.

1163. JONES, E. P. 634.3-2.78-2.96
The overwintering pupa of *Heliothis armigera* Hubn. (*obsoleta* Fabr.).
I. Effect of temperature and moisture.
Annu. Rep. Mazoe Citrus Exp. Sta. for 1936, being Publ. S. Afr. Co. 6,
 1937, pp. 19-36, bibl. 1. and
The egg parasites of the cotton boll worm, *Heliothis armigera*, Hubn.
(*obsoleta*, Fabr.) in Southern Rhodesia.
Ibidem, pp. 37-105, bibl. 17.

Studies of the overwintering pupa of the cotton boll worm (*Heliothis armigera*), a major pest of citrus in South Africa, show that infestation at Mazoe in August and September each year originates mainly from moths which emerge from the overwintering stage. The intensity is partly dependant on the proportion of pupae which produce an early emergence of moths. The author subjected overwintering pupae formed in April and May to experimental treatment of known values of temperature and moisture and noted results of treatment on emergence. These showed that the overwintering pupa is responsive to both temperature and moisture, that temperature is probably a contributory factor in determining the emergence of the moths, and that it is likely that such abnormal conditions as frequent showers during the winter will produce an earlier emergence and thus a severe outbreak of the pest on citrus. The experiments also show that other factors needing study as well as temperature and moisture are concerned in the problem.

In the second paper the author describes his investigations on two indigenous egg parasites of the cotton boll worm namely *Telenomus ullyetti* and *Trichogramma lutea*. The habits and bionomics of both host and parasites are noted. The two species are compared and their relationship to temperature moisture and each other are considered. Finally the possible economic importance of the two parasites is discussed in relation to boll worm infestation of citrus. A promising method of control suggested is the artificial breeding and liberation of parasites yearly during the egg-laying period of the host on citrus. The winter period is available for breeding and the liberated parasites would immediately reduce damage by killing the egg stage of the pest. *T. lutea* for climatic among other reasons is not suitable, but *Telenomus ullyetti* appears eminently fitted for the task. Before attempting its use, however, two points must be cleared up, namely, whether citrus groves are suitable for *Telenomus* activity and whether the range of the species is limited.

1164. MILLER, E. V. 634.3 : 581.175.11
A physiological study of the rind color of certain citrus fruits.
Science, 1938, **87** : 394-5.

1165. GUTIEV, G. 634.653.1-4
Avocado cultivation in U.S.S.R. [Russian, English summary 10 lines.]
Soviet Subtropics, 1938, No. 7 (47), pp. 77-9.

Under U.S.S.R.'s humid subtropic conditions avocado seedlings develop better on well-drained, heat conducting, sandy and rocky carbonate soils than on acid red and yellow soils or podzols.

1166. WARDLAW, C. W. 634.653
The avocado (*Persea americana* Mill) in the West Indies.
Trop. Agriculture, Trin., 1938, 15 : 225-6.

This paper was contributed to Section 6, Tropical and subtropical fruit growing, of the 12th International Horticultural Congress, Berlin, 1938. Improvement in certain directions is necessary to extend the consumption of the West Indian-grown avocado both as an export fruit and as a fruit for local use. (1) Horticultural qualities desired are high yields, disease resistance, extension of cropping period, and good keeping quality in cold storage, while from the commercial point of view palatability, oil content, size, appearance, and ratio of stone to pulp are important. Extension of the cropping season is improbable with the West Indian race, as these produce fruit during the summer and autumn months only, but the introduction of Guatemalan types which crop from November to May, either of the existing West Indian \times Guatemalan hybrids, or of Guatemalan scions, might assist in this direction.

1167. POMEROY, C. S. (Editor). 634.653
Avocado variety check list.
Yearb. Calif. Avocado Ass. 1937, 1937, pp. 13-34. and
Bibliography of avocado fruit illustrations—California varieties and introductions.
Ibidem, pp. 49-52, bibl. 26.

The first list includes some 450 varieties of avocado grown or described anywhere. Details are given of origin, of fruit characters, of season and of hardiness, at least when information is available on some or all of these points. Being as complete a list as possible, it contains a fair number of varieties which have never been or no longer are of commercial importance in California. This fact is noted. The bibliography of illustrations, which refers only to varieties which originated in California and those which have been introduced and have had rather general trial there, should be useful to those who wish to refresh their memories or know what any given variety looks like.

1168. HODGSON, R. W. 634.653
The University's research program on the avocado.
Yearb. Calif. Avocado Ass. 1937, 1937, pp. 228-33.

Work is being done by the University of California on the following aspects of avocado culture :—*Biennial bearing in the Fuerte*, the influence of girdling, pruning and early harvesting on it. No solution has yet been found. *Propagation*, (1) by cuttings and (2) from seed. *Rootstocks*, some 17 rootstock progenies are under examination, 16 of them being of Mexican horticultural race and the other probably a Guatemalan or hybrid. *Breeding for better varieties*.

1169. EGGERS, E. R., AND HALMA, F. F. 634.653-1.535 : 577.15.04
Rooting avocado cuttings.
Yearb. Calif. Avocado Ass. 1937, 1937, pp. 121-5.
 HAAS, A. R. C.
Propagation of the Fuerte avocado by means of leafy twig cuttings.
Ibidem, pp. 126-30.
 HAAS, A. R. C.
Further progress in the rooting of Fuerte avocado cuttings.
Ibidem, pp. 130-2.

The two first named workers report the results of two years trials with stem cuttings of Mexican seedlings, Fuerte and Nabal avocados. In seven tests made with Mexican seedling, rooting varied from 13% in one to 85% in another test ; no Nabal cuttings rooted and only 13% rooted in one test out of the seven in the case of Fuerte. As regards uniformity the cuttings are said to have shown just as much variation as seedlings and to differ from them only in the absence of taproot. In later experiments with Fuerte cuttings Haas' initial attempts to induce rooting by smearing with lanolin containing α naphthalene acetic acid and indole-3-acetic acid were

unsuccessful, but later he had considerable success in rooting untreated leafy twig cuttings. Large tip cuttings were used, approximately $\frac{3}{8}$ " in diameter at the base, 9-10" long and bearing 6-8 leaves from which the top halves were cut away. The cuttings were taken about mid-February and planted in sand in the rooting chamber to a depth of 3-4" where they were kept in a humid atmosphere at 80° F. By early May many of them were well rooted. Cuttings taken in late autumn rooted but required more time to do so.

Further work on the subject is reported in the third article. Fifteen to twenty leaf twig tip cuttings of Fuerte were collected at weekly intervals between October 1936 and August 1937. There was no success with the earlier samples despite the use of growth promoting substances. Those collected, however, late in December and in the early months of 1937 rooted readily. The tip halves of the leaves were removed and the cuttings were protected with cheesecloth over the glass sash of the rooting chambers. When the callus formation at the cut end was pronounced, a complete culture solution* made with tap water was sprinkled over the cuttings in the sand about once weekly, while at other times tap water alone was used. The cuttings found to have roots were transferred to separate compartments in the propagating frame, where they were sprinkled with nutrient solution every few days. After a few weeks the hardening process was carried on gradually by raising the sash a half inch more every few days. Finally after removal of the sash the cuttings were moved to the nursery row where for a time they might need protection from excessive light or heat.

1170. HODGSON, R. W., AND CAMERON, S. H. 634.653-1.542.24
Girdling to induce bearing in the Fuerte avocado.
Yearb. Calif. Avocado Ass. 1937, 1937, pp. 149-53.

Girdling, namely the removal of a complete ring of bark $\frac{1}{4}$ " wide, was carried out on 17 12-year-old Fuerte avocado trees with the following results:—If done just before flowering or during the first $\frac{1}{3}$ to $\frac{1}{2}$ of the blossom period it markedly increased set and yield of normal fruits. There was indication of a slight carry over effect to a second crop season. Regirdling appeared to have a similar but less pronounced effect.

1171. COIT, J. E. 634.653
Effects of the freeze on the avocado.
Yearb. Calif. Avocado Ass. 1937, 1937, pp. 70-5.

The author discusses the effects of the severe frosts of January, 1937, on avocado trees. Briefly they may perhaps be summarized as follows:—*Trees.* Effect varied greatly according to environment and variety. Thus the pure Mexican type suffered least, Fuerte and Puebla showed intermediate injury and pure Guatemalans were hardest hit. Older suffered less than younger trees. The dormancy induced by a longish spell of cold weather previous to the frosts prevented a good deal of damage. A noticeable effect on the trunks was a browning of the inner bark in patches and of the cambium itself. *Fruit.* At temperatures below 20° F. the fruit was frozen solid, after which it turned black and died. Less frost induced various decreasing grades of injury. Some fruits which showed little or no outward damage were seriously discoloured inside. *Blossom.* Where cluster buds were showing, these were killed. In many groves the frost destroyed the crops of 2 years, killing both blossom buds and mature fruits. *Seed.* Very many Fuerte seeds which appeared normal when planted were subsequently found to have a black dead spot at the base of the germ and to be useless. *Cultural programme.* Where trees were defoliated and partially killed back not all the fibrous feeding roots close to the surface remained necessary, hence the opportunity offered of cultivating despite damage to surface roots—and so suppressing noxious weeds. *Choice of varieties.* The Fuerte has shown a marked frost resistance, and a quick recovery when injured and has so deservedly gained favour at the expense of summer varieties which are relegated to other districts. *Nurseries.* Supplies were greatly reduced resulting in a temporary rise in price. *Disease.* An increase in *Dothiorella* disease is threatened by the greatly increased amount of dead brush on which spores of the fungus are produced.

* Details on page 68 of *Yearb. for 1936*.

Insect pests. Doubtful whether the balance is upset. *Market.* Fruits showing dark interior spots were initially viewed with suspicion. The flavour, however, is normal and eating quality is not thereby impaired. *Avocado industry.* The result is the elimination of marginal groves and of the practice of planting in cold positions. [N.B. Other articles bearing on problems arising out of the big frost include the following :—Marketing after the freeze, pp. 75-80. Standardization since the freeze, pp. 81-6, Lessons from the 1937 freeze (includes comparisons with the 1913, 1922 freezes and with orchard heating), Protecting avocados by heating, pp. 88-100, Recovery of avocado trees from the January freeze (grafting injured trees below those parts of the wood which were discoloured by the frost with good scion wood proved satisfactory. Claims in favour of whitewashing damaged trees and delaying pruning have not been substantiated), pp. 94-5.]

1172. MCKENZIE, H. L., AND LINDGREN, D. L. 634.653-2.944

Avocado fumigation investigations.

Reprinted from *Bull. Dep. Agric. Calif.*, 26, 1937, pp. 311-9.

This is a report on the monthly avocado fumigation tests carried out at the Citrus Experiment Station, Riverside, California, in 1934, 1935 and 1936. Notes are given on :—(1) the difference in gas tightness between 350 sheeting and the duck or drill tents as used in citrus fumigation ; (2) the diffusion and efficiency of powdered calcium cyanide, atomized liquid HCN and vaporized HCN ; (3) the season when the best results of scale control might be secured ; (4) the season when the tree was most tolerant to HCN ; and (5) the relative efficiency of powdered calcium cyanide and vaporized HCN during successive sets in the evening.

1173. VIDAL, D. 634.63

Soins à donner à l'olivier. (Cultural hints for olive growers.)

Progr. agric. vitic., 1938, 109 : 65-9, 91-3, 120-3. [Also supplements 8 pp. of figures, *Ibidem* Vol. 109, Nos. 4 and 6.]

The author deals with the following points : —1. *Manuring.* Three formulas are given in which farmyard manures form the basis in one and green manure or other organic substances the basis in the other two. 2. *Pruning.* This the author discusses at some length, noting that the essential is to prepare for adequate, annual fruit production. In principle the 2-year-old wood should be eliminated and the 1-year-old wood should be kept to fruit in its second year. A further aim should be to keep the tree open to the air and goblet shaped. *Pests and diseases.* The best known by its incidence and importance is fumaggine or noir and is due to a scale insect *Lecanium oleae* and a fungus *Capnodium oleophilum*. This can be controlled by bordeaux (as prepared for vines) plus essence of terebinth in the growing season, or by spraying with a winter wash consisting of arachis oil, oleic acid, commercial ammonia and water in the winter. Control of the olive fly can only be achieved by concerted effort and in France at least only legislation can make this possible.

1174. MORETTINI, A. 634.63 : 581.144/5

Importance de l'époque de différenciation des bourgeons à bois en bourgeons à fleurs chez l'olivier. (The importance of the time at which wood buds differentiate into flower buds in the olive.)

Bull. mens. Fed. int. Oléicult. 1937, No. 11, pp. 247-54, bibl. 4. [Also in Italian in *L'Olivicoltura*, 1938, ann. 15, No. 1.]

The author discusses first the theories propounded by Loew, by Klebs and lastly by Kraus and Kraybill to explain the factors which determine bud differentiation. He considers that the theory of Kraus and Kraybill that differentiation depends on the relation between carbohydrates and nitrogenous substances is the most reasonable. He next describes observations made on a Moraiolo olive in the grounds of the Agricultural Faculty at Florence. The procedure was as follows :—Branches of the current year's growth, from different parts of the plant, were removed every 15-20 days, starting on 1 July, 1936, and finishing on 20 April, 1937. The internal structure of the buds was examined in each sample taken. Numerous microscopical examinations resulted

in the discovery of the first manifestations of differentiation of wood buds into flower buds being seen in the first half of March, actually in sections taken on 3 March. Development into flower buds proceeded steadily after this date. On the 5 May the folioles composing the flower were clearly evident, but the flower was not yet properly constituted in its different parts, a fact which explained the long interval, i.e. about a month, which elapsed between the beginning of bud growth and its transformation into a flower. Thus olive buds, forming at the beginning of the growth season, which lasted under the conditions of the observations in the previous year from the second half of February till August, at which time a marked check in branch elongation was noticeable, remained undifferentiated during the succeeding period of autumn and winter until the following February. In the same variety and under the same conditions of the current year bud break started at the beginning of May and flowering in early June. Differentiation of buds in the olive takes place at the end of winter. In the current year and under conditions of the trial it preceded bud burst by a month and a half and flowering by two months and a half. Such a period is very short in comparison with that found in deciduous trees. It may thus be said that the fruiting cycle in the olive is accomplished within the year if it is remembered that its start coincides with bud differentiation.

1175. IVASHCHENKO, A. I.

633.85 : 581.14

Tung seed vernalization. [Russian.]

Soviet Subtropics, 1938, No. 5 (45), pp. 41-4.

It is a common practice along parts of the Caspian Sea Coast to sow tung seed direct in the field. This method although not entirely satisfactory is imperative given the climatic conditions (drought) there. In the search for a method to give earlier seed germination which under the above conditions is particularly desirable, a series of experiments were carried out at the Lenkoran Research Station for Subtropical Crops. The results which are tabulated may be summarized as follows :—Seed sown early (15 March) germinated on the 83rd day, whereas seed sown later (5 April) germinated on the 60th day. Sowing still later (22 April, 3 May, 10 May, 17 May) resulted in an average seed germination on the 50th day, and in healthier and more vigorous plants. Better results were obtained from certain heat treatments in sand in glasshouses and over hotbeds, to which the seed was subjected prior to sowing. Seed treated for 12 days over a hotbed (from which it was removed on 17 March) at 25° C. germinated on the 33rd day after sowing. Seed treated for 24 days germinated on the 27th day after sowing, while 30-day treatment over a hotbed resulted in germination of the seed on the 20th day. Glasshouse seed treatment at 20° C. for 30 days [under conditions of greater moisture content.—ED.] gave a yet earlier seed germination, i.e. on the 19th day. The difference in the height between treated and untreated seedlings was only slight, but the diameter of the seedlings raised from treated seed was considerably greater than the diameter of control seedlings. Plants obtained from treated seeds also produced more leaves and were healthier and harder than the controls. Seed treated with boiling water and left in water for 24 hours germinated on the 43rd day after sowing (which took place on 16 May). Seed treated with boiling water and left in water for 48 hours germinated on the 38th day. Control seed germinated only on the 52nd day. Seed with seed coats partly removed and sown on 16 May germinated on the 40th day. These seedlings scarcely differed in size from the control seedlings. Untreated tung seed sown in furrows germinated a little earlier than the controls (on the 50th day) and produced healthier and harder seedlings.

1176. MEADLY, G. R. W.

633.85

The tung-oil tree (*Aleurites Fordii* Hemsl.).

J. Dep. Agric. W. Aust., 1938, 15 : 253-7, bibl. 1.

Attempts have been made to establish *Aleurites Fordii* in Western Australia, not always with success. After 12 months from transplanting a lack of uniformity in growth is observed, the reason for which, apart from occasional injury obviously due to poor drainage, is difficult to diagnose, and frequently appears to depend on the condition of individual trees when planted.

Improved germination has been obtained by soaking the seeds for 48 hours prior to planting. Seeds should be obtained in husk and dehusked just before soaking. The nursery seed rows should be 3 feet apart, spacing between seeds 8 inches and depth of soil covering $1\frac{1}{2}$ inches. Germination should be complete in 60 days but some seeds take as long as a year. A fine tilth should be maintained and a well-balanced fertilizer is helpful. In about 9 months, during the dormant season, the plants, then normally 12-18 inches high, with a root system 12 inches long, should be transplanted to their permanent sites, with, if possible, a ball of soil on the roots. Sowing the seeds on their orchard sites is also to be recommended provided after-care is given. To ensure a profit 150 trees per acre in good bearing are necessary by the fifth or sixth year, 1,000 fruits per annum per tree being the minimum profitable yield. Clean weeding is advised with the growing of annual green manure crops between the rows.

1177. FORMANSKY, A. 633.85
The tung tree nursery at the Krasny Putilovets Collective Farm. [Russian, English summary 10 lines.]
Soviet Subtropics, 1938, No. 6 (46), pp. 38-40.

In 1937 tung tree seedlings were raised at a collective farm in Ajaria from *Aleurites Fordii* seed obtained from Sochi Research Station. 70% of the seed germinated. No losses occurred in the nursery when proper care was taken. The present experiment shows the desirability of early sowing, i.e. before April to obviate delayed transplanting* since sowing at a later date brings about an objectionable delay in transplanting of the seedlings. Sawdust was found to be the best material for mulching nursery beds.

1178. BATES, H. B. 633.85
Tung in the Trans Nzoia.
E. Afr. agric. J., 1938, 3: 463-4, bibl. 6.

A brief account of the establishment in Kenya of a tung plantation (*Aleurites Fordii*) from seed imported from China in 1930. Seed sent in the apple germinated well, but a later consignment, sent in error in the nut gave a much poorer germination. Seed should be planted only thumb deep and covered with leaves and chopped grass otherwise the plant may have difficulty in emerging. Germination may take 4 months.

1179. ELENEV, L. K. 633.85: 612.44.014
The effect of photoperiodicity on tung trees. [Russian, English summary 14 lines.]
Soviet Subtropics, 1938, No. 6 (46), pp. 51-2.

Photoperiodicity of the tung tree was studied for some time by the U.S.S.R. Scientific Research Institute of Humid Subtropics (VNIIVS). This article presents in a brief form the conclusions reached, namely:—(i) Both *Aleurites Fordii* and *Aleurites cordata* were found to respond extremely readily to changes in the length of light exposures. (ii) Short daylight interfered with normal vegetative growth of the plants and caused a 60% decrease (as compared with the controls) in the accumulation of protective sugars, but at the same time, it resulted in a fair maturity of the tissues which gives the plants greater hardiness. (iii) Plants subjected to long daylight produced stronger vegetative growth and accumulated more sugars. The amount of sugars somewhat exceeded that of the controls. It appears that an important factor increasing the hardiness of tung trees is the degree of maturity reached by the tissues and the development among them of protective fibres and woody tissues. In order to reconcile the different requirements of the tree it is suggested that special light treatment should be divided into 2 stages:—(1) a period of suddenly increased light exposure to stimulate vegetative growth, and (2) a period of suddenly decreased exposure to light in order to bring this vegetative growth to an end.

* See also Abstract 1175.

1180. WASSERMAN, I. 634.451

Persimmon culture in Japan. [Russian.]

Soviet Subtropics, 1938, No. 7 (47), pp. 68-72, bibl. 8 (Japanese).

In this paper the main points in the cultivation of persimmon (*Diospyrus* sp.) in Japan are discussed. This fruit in Japan comes second in importance to citrus. Notes are given on the choice of varieties, propagation, nursery practice, training methods, soils, fertilizers, pests and diseases, preparation of fruit, marketing, packing and drying. Data and tables increase the value of this somewhat brief article.

1181. POPOV, V. V. 634.985.5

Cork production in U.S.S.R. [Russian, English summary 11 lines.]

Soviet Subtropics, 1938, No. 6 (46), pp. 85-7.

In order to reduce the loss of cork acorns due to rodents special temporary cork oak seed beds are recommended. It is suggested that the old method of sowing acorns should be abandoned and early spring planting should be tried of sprouted acorns with trimmed roots. This method is said to result in a quite normal development of one-year-old cork oak seedlings. The advantage of planting sprouted acorns is that the storage of acorns during the winter months, which presents great difficulties, becomes superfluous. When planting, two acorns should be put in every hole. The space between the rows and between the plants in every row should be thoroughly cultivated. 300 to 500 trees may be grown on 1 ha. Since the cork cannot be taken from the cork oak trees until they are 15 years old the growing of quick yielding inter-crops is recommended.

1182. PYL'NOV, I. V. 632.64

Slug control in the humid subtropics of Azerbaijan. [Russian, English summary 11 lines.]

Soviet Subtropics, 1938, No. 8-9 (48-49), pp. 68-71.

Weed control, traps, baits and contact poisons are recommended as measures to combat slugs in Azerbaijan citrus groves and tea plantations. A new contact poison, prepared from the local plant *Cyclamen elegans* Bod., was found to result in 95.7% kill under field conditions. Spraying with it had no harmful effect on the plants.

TROPICAL CROPS.*

1183. WOOD, R. C. 631.58

Settled holdings in the tropics.

Trop. Agriculture, Trin., 1938, 15 : 147-53, bibl. 7.

The data obtained from an experiment at the Imperial College of Tropical Agriculture started eight years ago are examined with a view to determining the conditions necessary to obtain a settled property to the smallholder. Among essential conditions are the maintenance of the fertility of the land, with, if necessary, an initial compulsory manuring, probably best undertaken by the settlement authority ; the compulsory use of green manure crops with either free or cost price provision of the seeds to the settler ; where practicable the possession of live stock which both improves the land and provides the peasant with a change of diet ; the provision of some central store for the storage of settlers' foodgrains and ground provisions, since without it he will be compelled to sell at bottom prices, and inevitably spending the money thus acquired he will have to work for hire and the holding will be adversely affected. The author considers that whether the policy of attracting settlers to the land be sound or not it will be neither easy nor cheap.

* See also 932.

1184. HAMILTON, W. M., AND GRANGE, L. I. 631.4
The soils and agriculture of Western Samoa.
N.Z. J. Sci. Tech., 1938, 19 : 593-624, bibl. 9.

A survey of the soils and agriculture of Western Samoa was undertaken to determine the possible influences bearing on the recent small but perceptible diminution in plantation yields, which if not checked may make production unprofitable. The soils were divided into series based on the age of the lava flow from which they were derived and are described. The decline of productivity in coconuts is attributed to the interaction of 3 major factors : (a) increasing age and height of palms, (b) a high rate of palm mortality, (c) the gradual depletion of reserves of plant food in the soil, particularly on the older types. With cacao (c) seems to be a major cause in a soil already somewhat deficient in certain elements, while the severe root competition with windbreaks and interplanted shade trees is probably contributory. Suggestions are made for dealing with the situation.

1185. VROON, L. J. 371.2/3 : 63
 Geschiedenis en vooruitzichten van het landbouw-onderwijs in de provincie West-Java. (**History and prospects of agricultural teaching in the Province of West Java.**) [English summary.]
Landbouw, 1937, 13 : 505-49, bibl. 15.

Early attempts at the agricultural education of the natives of West Java, begun in 1911, were disappointing for the following reasons :—Wrong choice of villages in which the schools were placed, the families therein being not primarily interested in agriculture, too much theory and too little practice in the teaching, lack of capital to enable the pupils to start farming for themselves. A reorganization in 1921 has met with considerable success. Now the subjects are of simple technical matters and the courses given to older farmers with land of their own. The now well established demonstration plots of the Agricultural Service are effective witnesses. The early lectures were given by experienced men of standing, replaced by trained native teachers when confidence had been secured. Spontaneous associations of former pupils have come into being and are regarded as a valuable means of disseminating current information. As a result improved methods of agriculture, such as the planting of selected plant material and the use of green manures and fertilizers, have been put into practice over large areas.

1186. COSTER, CH. 631.459
 Bovengrondsche afstrooming en erosie op Java. (**Surface run-off and erosion in Java.**) [English summary 9 pp.]
Landbouw, 1938, 14 : 457-572, bibl. 59.

A very full account of experimental work on the study of erosion in Java. The English summary is well done and provides much information.

1187. TOFTE, C. R. 631.875
Compost making without watering.
E. Afr. agric. J., 1937, 3 : 171-2.

This method uses alternate layers of fresh cut Napier grass chopped into short sections of 3-4 inches and Napier grass similarly prepared but used as cattle bedding for 6 days previously, the heap being compacted with occasional thin layers of coffee pulp. The method differs from the Indore method of composting in the use of a single plant variety throughout and in the omission of the preliminary 2 day wilting of cut green plants. The moisture from the immature grass, which must be cut before it is 6 ft. high, takes the place of the copious watering required by the Indore process.

1188. BEELEY, F. 631.874 : 631.847.2
Nodule bacteria and leguminous cover plants.
J. Rubb. Res. Inst. Malaya, 1938, 8 : 149-62.

The biology of some legume plants used as cover in the tropics and the methods of turning this knowledge to the best advantage of crop and soil are discussed. The specific character of the

organism associated with the various species of leguminous crops and the consequent necessity of using the correct culture in field and seed inoculation is stressed. A simple method of preparation of cultures for inoculation which could be undertaken on estates, is described. A series of field experiments on different soil types to determine the value of inoculation in establishing and maintaining covers in rubber areas are briefly outlined. Possible reasons for the failure, when it occurs, of leguminous crops in Malaya are discussed under the headings: climate, soil, especially excess or deficiency in potash or inadequate aeration, shade, seed degeneration, diseases and pests, lack of suitable bacteria.

1189. BEELEY, F. 632.64 : 633.912

The giant snail (*Achatina fulica*) suggestions for control.

J. Rubb. Res. Inst. Malaya, 1938, 8 : 130-9, bibl. 5.

Meta and bran at a concentration of $\frac{1}{2}$ oz. of Meta to 1 lb. of bran put out (1 small heap or dessert-spoonful) at 10 yard intervals has proved an effective poison bait for the control of the giant land snail in plantations in Malaya. This bait, however, though spectacular in its effects is expensive and non-lasting, particularly if not shielded from rain. It is suggested that a preliminary clearance of the snails by the use of Meta should be made and followed by the distribution of permanent baits in the form of poison-lime bricks. These bricks are made by mixing 1 part calcium arsenate, 6 parts slaked lime and 2 parts cement by volume (or 1:4:2 by weight) with sufficient water to form the consistency of an ordinary concrete mix, then allowing to solidify in slab form on a piece of paper. The bricks are put out in the field and remain effective for many months or even two or three years if placed in a reasonably dry situation. Their attraction for the snails lies in the lime they contain.

1190. JOOSTEN, J. H. L. 632.693.2

Systematische rattenbestrijding in West-Krawang in het seizoen 1936-37.

(**Methodical combating of the field-rat in West Krawang in 1936-37.**) [English summary.]

Landbouw, 1938, 14 : 1-47.

A systematic campaign against the field rat in the rice district of West-Krawang was extremely successful. The value of the crop in 1934 when methodical control started was 43,000 florins, in 1937 as a result of the campaign it was 975,000 florins. The methods were both indirect, i.e. quick planting of the whole area, the growing of early varieties and the creation of unfavourable circumstances for the rat in field and village; and direct, in which the leading principle was that all the work should be done by the farmers themselves, consisting chiefly of intensive poisoning at certain seasons. The Agricultural Service acted as organizer and supervisor, and maintained a constant propaganda, chiefly by village meetings.

1191. PICKLES, A. 632.951

Insecticides for the control of certain Trinidad crop pests.

Trop. Agriculture, Trin., 1938, 15 : 126-31.

The article is directed to the use and preparation of insecticides suitable for use under Trinidad conditions. Special attention is given to the destruction or repelling of ants. The recommendations are to be amplified later by more specialized publications dealing with individual crops.

1192. PLUMMER, C. C. 632.77 : 634.1/7

The toxicity of *Haplophyton cimicidum* A.DC. to fruitflies.

Circ. U.S. Dep. Agric. 455, 1938, pp. 10, bibl. 8.

Haplophyton cimicidum A.DC. (cockroach plant) has long been used in Mexico for the control of various insects and among them of the Mexican fruit fly (*Anastrepha ludens*). Extracts of the plant used as sprays proved a very effective control measure against the latter insect. This is confirmed by recent toxicity tests. Toxicity data were taken under varied conditions of temperature, concentration of spray, molasses content and age of spray. In the insectary the

sprays did not lose their toxicity when held for 58-59 days in solution or mixed with molasses and dried on mango foliage. In the laboratory sprays lost little of their toxicity after being held 190 days in solution without molasses. Sprays mixed with molasses and held dry on glass plates at 30° and 35° C. with 30% relative humidity for 310 days retained much of their toxic property. A spray held in solution for 190 days, and then mixed with molasses and dried on glass plates held at 30° and 35° C. with 30% relative humidity for 358 days, remained slightly toxic. An extract held without molasses at room temperature for 527 days was not toxic. Sprays of the lowest molasses content were the most effective. The spray containing 3.3 g. of dried leaves of a good sample per 100 cc. was found to be toxic to fruit flies. Some samples of the plant are non-toxic or only slightly toxic to the fruit fly. Paralysed flies only very rarely recovered from the effects of the poison. The toxic effect of the plant is attributed to either an alkaloid or a salt of an alkaloid or an alkaloid glucoside.

1193. GREENWAY, P. J., MARSHALL, T. H., AND HARRIS, W. V. 633.513
Kapok.

E. Afr. agric. J., 1938, 3 : 440-5.

The 3 authors have each contributed a section to this paper, under the respective headings, 1 the botany and agronomy of kapok, 2 kapok in Tanganyika, 3 pests and diseases of kapok. 1. The cultivation methods are briefly described, the information being chiefly from Dutch East Indian sources. 2. Cultivation of kapok as a pure crop instead of a boundary tree is gradually being taken up in Tanganyika, but is still largely in the experimental stage. Spacing distances are undecided but over 8 metres seems necessary on good land. The topping of trees has been tried to facilitate picking but the expense of having to remove many of the resulting suckers and shoots is probably unjustified. Two varieties are recognized in Tanganyika, one variety bearing larger pods but having unfortunately a tendency to biennial bearing. 3. The only major pest in Tanganyika is the mealy bug *Phenacoccus iceryoides* Green. Diseases are relatively unimportant.

1194. DEN DOOP, J. E. A. 633.513-1.541.44
 Kapok-oculaties op takken. (Topworking kapok.)
Bergcultures, 1937, 11 : 1644-6.

Kapok trees which require topworking may be successfully treated by the following method. Three buds are placed in a row on each of the 3 branches of a tier, either near the trunk or farther out in the case of scion varieties of horizontal growth habit. As soon as union is complete the branch is cut off at the bud: later when growth starts only the strongest of the three buds per branch is retained. The central leader stem of the tree can either be removed or left in position to carry another tier for similar treatment. It is suggested that since a long spread over of the kapok harvest is an important factor in its successful gathering, early mid-season and late varieties could be budded on the same trees, and thus reduce the loss occasioned by failure [through labour difficulties presumably.—ED.] to gather all the crop at the correct moment.

1195. NUTMAN, F. J. 633.526.2
 Some mechanical characters of *Agave* fibres.
E. Afr. agric. J., 1937, 3 : 138-42.

Methods for testing with locally devised machinery (Tanganyika) the fineness, tensile strength and breaking-length of sisal are described. Their utility lies chiefly in facilitating the selection of new *Agave* types but the data obtained can contribute to the solution of many practical problems, for instance those connected with the maturity of the leaf. By the application of these methods it has been found that:—(1) The average strength of the fibre in a leaf increases with the age of the plant at which the leaf was formed. This increase is due to an increase in the proportion of the strong fibres. The intrinsic strength (i.e. the breaking length) also increases slightly. (2) The number of fibres per leaf and the weight of fibres per leaf remain relatively constant at least over the period when cutting normally takes place. (3) There are more long fibres in the later leaves. (4) It is probable that the proportion of long and short fibres, the

number, the weight and the strength of the fibres from a leaf do not alter to a sufficient extent to be commercially detectable after it has unfolded from the central bud. Thus it is concluded that no maturation of the leaf takes place, at least after the leaf has grown large enough to be of commercial importance, and that, supposing it were not physiologically inadvisable, even if leaves were cut right up to the central bud there would be no adverse effect on fibre quality and quantity. Experiments on the optimum severity of cutting are now in progress.

1196. DEN DOOP, J. E. A. 633.526.23

The utilization of sisal waste in Java and Sumatra.

E. Afr. agric. J., 1938, 3 : 423-38, 4 : 89-99.

This is an exhaustive account of past and present methods of utilizing sisal waste in the Dutch East Indies. There is a note by W. E. Calton of Amani Research Station, in which the technical soil terms used are explained and the East Indian soil conditions reduced to terms of those of East Africa.

1197. LAYZELL, S. C. 631.874 : 633.526.23

The composting of sisal waste.

E. Afr. agric. J., 1937, 3 : 26-9.

A method employed on the Taveta Estates, Tanganyika, is described by which solid sisal waste is composted and the liquid waste is used for irrigation purposes to grow food crops to supplement the rations of the native workers. The stream pollution or accumulation of evil smelling refuse, which is one bugbear of sisal manufacture, is eliminated, the land benefits by the return of the compost to the soil and the food plantations by their suggestion of plenty prove of great value in attracting native labour, and have in addition benefited its health and physical fitness.

1198. PICKLES, A. 632.951.1 : 632.754 : 633.61

A note on pyrethrum as a possible insecticide for the control of sugarcane froghopper.

Trop. Agriculture, Trin., 1938, 15 : 75-6.

Small scale experiments in Trinidad seem to indicate that pyrethrum dust may prove an effective insecticide against froghopper on sugar cane. The powder does not adhere well to the leaves, but slides down into the axils in which the froghoppers mainly shelter during the hot part of the day.

1199. BAKHTADZE, K. E. 633.72-1.531

Tea seed production. [Russian, English summary 20 lines.]

Soviet Subtropics, 1938, No. 7 (47), pp. 28-33.

In Georgia tea seed is usually obtained both from special seed gardens and from ordinary plantations. A great drawback in obtaining seed from high yielding tea strains is the antagonism existing between vegetative growth and generative activity which is characteristic of tea plants. The author considers the present methods of producing seed highly unsatisfactory. He therefore recommends that high yielding plucking plots should temporarily be used as seed gardens and that an extensive use of vegetative propagation should be made.

1200. TALYBLY, G. A. 633.72

The reasons for failures among tea plants in Azerbaijan. [Russian.]

Soviet Subtropics, 1938, No. 6 (46), pp. 22-30.

In this article, which is the result of investigations at the Lenkoran Research Station, the following factors as affecting healthy development of tea plants in Azerbaijan are considered :—Preparation of soil, drainage, transplanting from the nursery, root development, temperature and moisture conditions, the use of green manures and protective measures against drought.

1201. VORONTSOV, V. E. 633.72 : 663.952.1/4

Conservation of aroma and flavour in tea. [Russian.]

Soviet Subtropics, 1938, No. 5 (45), pp. 27-35, bibl. 9.

In 1937 monthly organoleptic tests were made by Glavchai (Central Tea Organization) of Georgian teas packed in different ways. Mould, water content in packed tea and the hygroscopicity of tea are discussed. Certain measures during preparation and packing are suggested by which conservation of aroma and flavour in Georgian tea may be improved.

1202. KIRYUKHIN, G. 632.944 : 633.72

Hydrocyanic acid fumigation on tea plantations. [Russian.]

Soviet Subtropics, 1938, No. 6 (46), pp. 63-7.

HCN fumigation proved to be a commercial proposition on U.S.S.R. tea plantations. In this article practical directions are given including notes on the time of fumigation, on the process of fumigation, on the effect of fumes on plants and on plant parasites, on costs involved and labour. Precautionary measures and first-aid in the event of gas poisoning are described.

1203. MIYAZAWA, B. 633.72 : 581.145.1/2

Differentiation period of flower buds in tea plants. [Japanese.]

Agric. & Hortic., 1937, 12 : 1084-92. Abstracted in English (11 lines) in *Jap.*

J. Bot., 1938, Vol. 9, No. 2, Abstr. 216.

YAMASHITA, K.

633.72 : 576.312.35

The chromosome number of wild tea plants in Formosa. [Japanese.]

Agric. & Hortic., 1937, 12 : 1583-4. Abstracted in German (6 lines) in *Jap.*

J. Bot., 1938, Vol. 9, No. 2, Abstr. 324.

1204. VAN HALL, C. J. J. 633.73-1.521

Coffee selection in the Netherland Indies.

Trop. Agriculture, Trin., 1938, 15 : 87-90.

This paper is a brief résumé of the coffee selection work of the Dutch in Java which began in 1907 under Dr. Cramer with the selection of mother trees both for seedling and vegetative propagation. The information has appeared from time to time in an expanded form in the various agricultural research publications of the Netherland Indies, usually under the names of the workers engaged thereon.

1205. MILNE, G., AND (in Part III), SAVILE, A. H. 631.4 : 633.73

Essays in applied pedology. I. Soil type and soil management in relation to plantation agriculture in East Usambara. II. Some factors in soil mechanics. III. High and low fertility on a laterized soil.

E. Afr. agric. J., 1937, 3 : 7-20, bibl. 18, 3 ; 350-61 ; 1938, 4 : 13-24, bibl. 8.

I. The history of arabica coffee planting in forest clearings in East Usambara, Tanganyika Territory, is briefly sketched from its beginning in 1891, through the decline of the plantations during the decade before the war of 1914-18 to their almost complete abandonment at the present day. The soil (a laterized red earth on gneiss) is described in relation to the factors in its formation and particularly in its relation to the evergreen forest. The effects of clearing and non-intensive plantation practice are traced, and the conclusion is drawn that the hope now being entertained of bringing old coffee clearings again into production under other permanent crops depends for fulfilment on the adoption of intensive methods on small acreages. II. The texture and consistence in tropical soils, soil structure under different vegetation types, and loss of structure in cultivation are discussed, and the importance of soil structure maintenance as a definite policy in the tropics is emphasized. III. Soil conditions in the humid eastern

part of Bukoba District on the west side of Lake Victoria are examined in the light of natural factors in soil formation which have led to general poverty in plant nutrients and in the light of effects of human occupation.

1206. GILLET, S., AND JACKSON, T. H. 633.73-1.535 : 577.15.04
The effect of growth substances on the stimulation of root growth in cuttings of *Coffea arabica*.

E. Afr. agric. J., 1937, 3 : 229-34.

Experiments with growth substances on cuttings of *Coffea arabica* at the Scott Agricultural Laboratories are described. A good percentage of rooting was obtained by treatment with β -indolylacetic acid, 1 in 10,000 parts water, but at a concentration of 4 in 10,000 injury occurred and root formation was inhibited. Hortomone A, 1 in 150 parts water, was also successful. The cuttings were rooted in a propagator with enough bottom heat to keep the rooting medium of peat and sand at a temperature of 24°C.

1207. MULDER, H. H. 633.73-1.541
 Hoe beïnvloeden wij het slagingspercentage van onze koffie-enten. (**How we influence success in our coffee grafts.**)
Bergcultures 1937, 11 : 1371-2.

On the author's estate coffee grafting had little success, the scions beginning to grow but later dying off. The grafts were (apparently) cleft-grafts on young seedling stocks in nursery beds, which were decapitated and stripped of leaves before grafting and after grafting covered with glass or oiled paper tubes. The average success was only 20%. As an experiment it was decided to let the lower leaves remain on the stock. After this the author says that he seldom found a dead graft and that a 95-100% success became a foregone conclusion.

1208. FERWERDA, F. P. 633.73-1.547.6
 Gegevens over den ontwikkelingsduur der vrucht bij verschillende koffiesoorten. (**Length of time required by various coffee varieties to mature their fruit.**)
Bergcultures, 1937, 11 : 198-203, bibl. 5.

The time taken between blooming and ripening for various coffee varieties has been studied in Java. Thus robusta and its related forms require 318 days, conuga 313, liberica-arabica hybrids 306, and robusta-excelsa hybrids 357. Flowering of all varieties is, of course, not simultaneous but as a general rule it can be laid down that the varieties requiring the shortest time for development will be first ready for picking, provided they have a clearly defined flowering peak period. In interclonal planting for cross-pollination it is obviously advantageous to group together clones which as well as flowering will also ripen simultaneously. In hybrids, length of ripening period appears to be a character acquired exclusively through the female parent.

1209. DELAP, F. 633.73-1.542
A rational formula for multiple stem pruning.
E. Afr. agric. J., 1937, 3 : 64-9.

Advice is given on general pruning of coffee on the multiple stem method, including the systematic "cutting up" of all primaries which have borne within a few inches of the tip (this usually coincides with two years cropping), and the thinning out of excessive growth. To establish a new cycle of suckers the stumping of the best head at a height of 1 ft. 6 in. above ground level is advocated; this, in the opinion of Mr. Trench, late Senior Coffee Officer of the Kenya Department of Agriculture who contributes a foreword, will cause undue loss of crop since he considers that strong healthy suckers are produced from any original healthy verticals. The author agrees to the point on sucker production, but nevertheless prefers the original best head when possible.

1210. S'JACOB, J. C. 633.73-1.8
Voedingsphysiologische onderzoeken bij *Coffea arabica* I. (Physiological experiments on the nutrition of *C. arabica*.)
Arch. Koffiecult. Ned., Ind., 1938, 12: 1-48, bibl. 51.

Shive's* culture solution was found to be the most suitable of a number tried and was used throughout the author's nutritional experiments with *C. arabica*. The following observations were made. With *Coffea arabica* grown in culture solution nitrogen deficiency produced very small plants with yellowish leaves. Root length increased with a decrease of nitrogen concentration. Excess nitrogen (3 times the normal) produced plants superficially resembling those receiving $\frac{1}{10}$ of the normal, but with a very much shorter root growth, and with a dark green leaf. Calcium deficiency produced severe root damage and convex rounded leaves with early dying off of the plants. Excess calcium as CaCl_2 seemed harmless, but as CaCO_3 produced chlorosis. With lack of potassium small grey dry spots are found on the edges of leaves. Excess of potassium causes light yellow marbling of the leaves with short thick roots. Phosphorus deficiency symptoms were unobtainable owing to the difficulty of freeing the culture solution from all traces of phosphorus. Excess phosphorus produced no symptoms. Magnesium deficiency caused a typical zonal spotting; within the zone the leaves are slightly chlorotic, and without are apparently healthy. Excess of magnesium produced weak and chlorotic plants but no characteristic symptoms. Sulphur deficiency resulted in very small plants with yellowish convex leaves and small thick roots. Excess of sulphur produces the same symptoms as those produced by cultivation in a too high total concentration of the culture solution. With excess sodium chloride the leaf margins became reddish brown and dry with the leaves themselves convex and hanging vertically along the stem. The damage seems to be caused by the sodium ion. Iron deficiency caused chlorosis and light green veins. In another series of experiments it was shown that ammonium salts at pH 4.5-5.0 can be used as a source of nitrogen, but that at a lower pH they are harmful. Similar experiments using a neutral or alkaline reaction failed owing to the impossibility of making a solution with a low acidity in which the coffee did not become chlorotic, even when nitrates were given. The effect of cultivating plants in $\times 5$ normal concentration of the culture solution used was to produce symptoms closely resembling those of a disease recently described by H. J. de Fluiter, "Over het verschijnsel der 'pseudogalvorming' bij koffiewortels," *Bergcultures*, 1936, vol. 10.

1211. GILBERT, S. M. 633.73
Variability in yield of *Coffea arabica*.
E. Afr. agric. J., 1938, 4: 131-9, bibl. 2.

The results of 4 years' yield records of 500 trees of *Coffea arabica* in Tanganyika are presented. There is a pronounced biennial bearing habit, with the majority of the trees in step. The unsuitability of such material for field experiment without previous knowledge of yields is obvious. How the method of co-variance can enable accurate experiments to be done on such material is explained.

1212. VENKATARAYAN, S. V. 633.73-2.19
Coffee black bean.
Reprinted from *Current Science*, 1938, 7: 113-4, bibl. 6.

Black bean of coffee (see also abs. 1361) is here tentatively attributed to lack of fertilization due to absence of pollen or its incompatibility. The unfertilized fruit would still develop parthenogenetically but the embryo would be undeveloped as is the case in black bean. Many of the coffee bushes may be of natural hybrid origin and it is known that the phenomenon of parthenogenesis is often exhibited by hybrids.

* Shive, J.W.A. A study of physiological balance in nutrient media. *Physiol. Res.* 1914, Vol. 1.

1213. ANSTEAD, R. D.

633.73

A note on "quality" in coffee.*Agric. Live-Stk India*, 1938, 8: 148-52, bibl. 10.

The attempts made in past years (from 1886) to determine of what "quality" in coffee consists are briefly reviewed. The scientist needs a test which has if possible a numerical expression which will not vary and will give the same results no matter who uses it or when or where it is used. So far no such test has been evolved but in view of the work now in progress on the subject the author thinks the present summary and the references attached may be helpful in indicating possible lines of approach.

1214. VOELCKER, O. J.

633.73

Cacao. A summary of literature since 1931.*Seventh annu. Rep. on Cacao Research for 1937*, I.C.T.A., Trinidad, 1938, pp. 20-30, bibl. 55.

This summary is a sequel to "Economic botany of cacao" which surveyed the literature of cacao research to the end of 1930 (issued as a supplement to *Trop. Agriculture, Trin.*, June, 1932, by Cheesman, abstracted at some length *H.A.*, 2:285). The work on selection in different countries is reviewed and the following are the summaries. *Trinidad. Criteria.* 1. Not more than seven pods to produce 1 lb. of cacao. 2. Yield not less than at the rate of 1 ton of dry cacao per acre. *Precautions taken.* 1. Allowance for pod value. 2. Allowance for tree size. 3. Yield records over not less than two seasons. 4. Selected trees on different soil types. *Population.* 1. Trees examined 50,000. 2. Preliminary selection 1,000. 3. Final selection 100. *Nigeria. Criteria.* 1. Yield in pods per tree. Average over 10 years at least 70 pods and over the latter 5 years at least 90 pods. 2. General appearance. Red pod types discarded. *Precautions taken.* 1. Records over one complete season taken in pounds of wet cacao. 2. Conversion of previous pod records into weight of cacao. *Java. Criteria.* 1. Yield in pods per tree. Average over 2 or more years to fall within the best quintile* or bisquintile. 2. Tree to yield a proportion of white beans. 3. General appearance and resistance to moth. *Precautions taken.* 1. Yield records taken for more than one year. 2. Elimination of environmental influence by the best quintile method of selection. 3. Examination of bean colour. 4. Selection on a number of estates. *Population.* No figures available. *Propagation.* The technique has been fully summarized by Pound (*4th annu. Rep. for 1934, H.A.*, 5:470). Chief interest lies in the incompatibility of certain scions for seedling stocks which profoundly influenced success or failure of the take. Clonal propagation of root-stocks by means of semi-softwood cuttings struck in propagators in which temperature, light and humidity can be controlled was found easy and reliable, at least on a small scale. (Cheesman *5th annu. Rep for 1935, H.A.*, 6:572.) In Java attempts to eliminate some of the variability caused by the use of seedlings for field planting are made by the use only of trees raised from pale beans. *Pollen incompatibility.* The cause of pollen self-incompatibility is not yet established. It is absent in West African cacao except in the case of certain introduced types; at present it may be considered as being governed by genetic factors. Urgent problems awaiting research are its effect on yield and its reduction or elimination by plant breeding methods. *Flowering, natural pollination and fruit setting.* There is little if any correlation between the fluctuations which occur in the incidence of flowering and setting in Trinidad. In Trinidad incidence of flowering may be controlled to some extent by nutritional changes, but the incidence of setting recorded as a percentage of flowers produced remains unchanged in extent or time. In Nigeria and Trinidad there are periods of high percentages of setting and in Java periodic fluctuations in number of flowers pollinated have been observed. Artificial hand pollination during periods when the number of natural pollinations was small did not increase the number of pods harvested. *Cherelle wilt.* Voelcker in the current report (for 1937, abst. 1216) concludes that the cause of wilting of cherelles is to be found in the physiological condition of the tree and not in the cherelle, which at 50 days old is beginning zygotic divisions. Until clonal material is available, reliable observations will be difficult to obtain. *Cultivation.* With the notable exception of

* Quintile = highest yielding fifth of the field's population; bisquintile = highest yielding fifth of the quintile.

the fundamental work on the nutrient requirements and environmental conditions necessary for the expression of health, growth and high yield carried out under Hardy by McDonald (*1st and 2nd annu. Rep. for 1931 and 1932, H.A., 3 : 402*) research has been confined to trial and error experiments of which the results are not yet known. *Soil.* The soil requirements of cacao have been summarized by Jacks (*Tech. Comm. Imperial Bureau Soil Science, Rothamsted, 34, 1936*). Put very briefly these are, a slightly acidic soil—though wide tolerance is shown—even moisture conditions with good drainage, high content of organic matter in the surface layers, a high phosphate content, adequate supplies of available soil potash. Calcium carbonate content does not appear to exert much influence on the yield. Excessive calcium sulphate in the soil is detrimental to growth and yield. *Atmospheric environment.* Hardy and Macdonald (*1st and 2nd annu. Rep. for 1931 and 1932, H.A., 3 : 402*) have shown that cacao is affected by extreme fluctuations of atmospheric humidity, thus shade, windbreaks and drainage will tend to stabilize atmospheric conditions and reduce the frequency of leaf fall and growth flushes, which have been found detrimental to flowering and development of cherelles. *Manurial requirements.* Outstanding beneficial results have been achieved by the use of phosphatic manures on certain soil types in Trinidad, but it is not known whether the increase of pods following phosphatic manuring on calcareous marls may be the result of more extensive flowering, of a higher percentage setting or of less cherelle wilt. In Ceylon and the Gold Coast manurial experiments were demonstrably economic. *Rejuvenation.* Cacao trees which for any reason consistently gave poor yields are profitably replaced by surplus of the best planting material. Attempts to replant a defective soil are unprofitable. *Diseases.* Witchbroom disease can be successfully controlled in Trinidad by the frequent cutting off of brooms and by general pruning to limit the number of growing points at which infection can take place. Seeds from apparently resistant strains from Ecuador and the Amazon valley are being tested. On the West Coast of Africa black pod (*Phytophthora* spp.) can be kept in check by frequent and regular harvesting and the early removal of infected pods.

1215. VOELCKER, O. J. 633.74 : 581.162.3
Self-incompatibility in cacao II.*
Seventh annu. Rep. on Cacao Research for 1937, I.C.T.A., Trinidad, 1938,
 pp. 2-5, bibl. 7.

In a previous report* it was shown that out of 19 cacao trees of the College Selection group at River Estate tested for self-incompatibility only 5 were self-compatible and there was no change from self-incompatibility to self-compatibility during 6 months, July 1936-January 1937. The results of further work during the heavy flowering flush of May are embodied in this present paper and confirmed the previous opinion that self-incompatible trees crossed by self-incompatibles cross very poorly or not at all, but set satisfactorily when crossed by self-compatibles. No change from self-incompatible to self-compatible occurred during a year. Thus if these conclusions hold good for the plantation, as presumably they do, the value of self-compatible trees becomes very great since they have to supply all the pollen for the self-incompatible trees as well as for their own flowers. This may explain the generally fruitless results of the May flowering or "crazy" flush, at which time pollinating agents are largely absent though they increase rapidly after the rains in time for the later flowering. Self-incompatible trees hand pollinated during the May flowering set fruit as well as at any other time.

1216. VOELCKER, O. J. 633.74 : 581.162.3 : 632.19
A note on the behaviour of cacao flowers after pollination and on the incidence of cherelle wilt.
Seventh annu. Rep. on Cacao Research for 1937, I.C.T.A., Trinidad, 1938,
 pp. 5-8, bibl. 7.

Pollination. There is considerable variation in length of time between pollination and the falling of the cherelle and this should be recognized in determining whether a tree is self-compatible or not. The setting limit should be taken in experimental work as being 14 days which

* Part I. *Ibidem* for 1936, *H.A., 7 : 1,027.*

gives ample time and causes little error if the limit is reduced or expanded by two or three days. There is also a daily fluctuation in the effect of pollination which is shown to be due to the quantity of pollen reaching the stigma. In testing trees for incompatibility a number of pollinations should be made over several days. A tabular comparison is made between cherelle wilt of the five compatible River Estate trees (see previous abstract) and six self-compatible Nigerian trees. Self-incompatibility does not appear to occur in Nigeria. *Cherelle wilt*. It is thought from an examination of the data that cherelle wilt does not proceed from changes caused by the growth of the embryo or from any causes within the cherelle but physiological phenomena within the tree itself are of primary importance in determining whether wilt will occur.

1217. VOELCKER, O. J. 633.74 : 581.162.3

The incidence of cross-pollination in cacao.

Seventh annu. Rep. on Cacao Research for 1937, I.C.T.A., Trinidad, 1938, pp. 9-14, bibl. 6.

The application of Harland's and Frecheville's* methods to determine the amount of cross-pollination among 18 River Estate trees, together, where possible, with a check by examination of bean colour, revealed a very high degree of cross-pollination. In self-compatible trees up to 50% of pods were cross-fertilized. A higher percentage was proved for self-incompatible trees, but the method did not allow of conclusive proof that all pods on such trees were the result of cross-fertilization. The fertilization of different flowers by different male parents or by mixed pollen was indicated. The danger of frequent cross-pollination probably by inferior male parents was stressed in relation to seedling planting material.

1218. VOELCKER, O. J., AND COPE, F. W. 633.74-1.55

Some factors controlling the yield of young cacao. I.

Seventh annu. Rep. on Cacao Research for 1937, I.C.T.A., Trinidad, 1938, pp. 14-8.

Investigations are proceeding to account for the variation in yield so frequent among cacao trees of similar age and vigour. The 6 trees under examination were open-pollinated seedlings of six selected parent trees. In order that no influencing factor may be missed there are being recorded for each tree intensity of flowering, degree of cherelle setting and number of losses between setting and harvest, also any correlation between self-compatibility and high yield is to be established. Since the trees under observation form part of a manurial and cultivation trial it is hoped to be able to record at what stage the fertilizers act with maximal effect. Detailed results cannot be presented for a year, but general conclusions to be drawn already are : (1) self-compatible trees always set a far higher percentage of cherelles than self-incompatible trees ; (2) cherelle wilt is rather more severe on self-compatible trees but this only very slightly affects the much greater bearing of the self-compatible tree ; (3) flower production is the same for both classes of tree.

1219. POSNETTE, A. F. 633.74 : 581.162.3

Incompatibility and pollination in cacao. [Summarized by O.J.V.]

Seventh annu. Rep. on Cacao Research for 1937, I.C.T.A., Trinidad, 1938, pp. 19-20.

The paper is divided into two portions. The first deals with pollen incompatibility and the second with natural pollination of cacao. No difference was found between the germination of pollen grains when taken from self-compatible or self-incompatible trees, and no structural or staining differences could be noted in the styles or stigmatic lobes of the flowers from either of the two types of trees. Microscopic examination was difficult but in one compatible pollination a pollen tube was seen entering the ovary and the incompatible pollinations showed a number

* Harland, S.C. and Frecheville, G.E. "Natural crossings and the genetics of axil spot in cacao." *Genetica*, 1927, 9 : 279-88.

of short, darkly stained tubes ending abruptly in an inflated tip and sometimes growing away from the ovary and up the style. (In both self-compatible and self-incompatible flowers some of the growing pollen tubes did not take up the stain but remained clear and it was suggested that the clear tubes might have already passed their contents down the style.) Pollination experiments showed that the self-compatible flower was capable of setting with its own pollen from the time of anthesis to late in the afternoon of the same day and that pollination at the base of the style without contact with the stigmatic lobes was enough. Attempts to establish the identities of the insect pollinating agents during the period February to May point to certain ants, especially nocturnal ants, and to some drosophilids in rainy weather.

1220. DUTHIE, D. W. 633.74 : 581.192

Observations on the biochemistry of the cacao kernel. Tannin and catechin.
Seventh annu. Rep. on Cacao Research for 1937, I.C.T.A., Trinidad, 1938,
 pp. 47-51, bibl. 6.

Methods are described of estimating tannin in fresh and fermented cacao kernel and are modified to include a separate determination of catechin and similar phenotic substances. No marked changes in tannin or catechin take place between the picking ripe and fully ripe stages. Thus in trials in which tannin and catechin content are involved an exact equality of ripeness in the samples is not necessary. The difference in quality between Criollo and Forastero could not be accounted for by their slight differences in tannin and catechin content. Colour of bean appears to have no relationship to tannin content. In manurial trials beans from the potash plots had slightly but not significantly higher tannin and catechin contents. A rapid and marked drop in catechin content was observed during fermentation and drying. Tannin and catechin contents of fresh beans cannot be used as a criterion of quality but the drop in catechin content may have some significance in the ameliorating effect of fermentation.

1221. GREEN, E. C. 633.74-1.531

The germination of cacao for planting.
N. Guinea agric. Gaz., 1937, 3 : 43-55.

A series of observations undertaken in New Guinea to discover whether various failures to break ground or the presence of twisted and distorted stems in cacao seedlings are due to avoidable practical causes are described with many illustrations. Germination began on the fifth day and all beans had germinated by the eighth day. The position of the hilum and the depth of planting up to four inches do not affect the germination of the bean. Distortion of the hypocotyl and of the above-ground stem occurred when the seed was planted 1-2 inches deep with the hilum upwards but not when it was downwards or sideways. At 3-4 inch depths distortion of the hypocotyl occurred, whatever the position of the hilum, and the seedlings were unable to break ground even after 30 days. The best results in strong, well-formed seedlings were obtained when the seed was covered to a depth of 1 or 2 inches and the hila were downwards or sideways.

1222. KARUNARATNE, C. R. 633.825

Cultivation and preparation of ginger and turmeric.
Trop. Agriculturist, 1937, 89 : 350-8.

The cultivation of ginger and turmeric is identical and in Ceylon they are often grown in combination. The leaves of the turmeric stand above those of the ginger and provide it with a light beneficial shade. Success in cultivation depends largely on the texture of the soil which should be friable and loose to a depth of at least 5 inches. It should be freely worked to a depth of 9-12 inches in the two months before planting. On flat lands particularly good drainage is essential and this may be secured by raised beds, 12×6 ft., ridge and furrow with the ridges 24 inches apart and a furrow between them and by the broad ridge method where the ridges have flat tops 3-4 ft. wide with an 18 inch furrow between. Subsidiary crops of yams can be grown at the same time, the vines being trained up posts and spaced 15 to 20 ft. apart. Plump rhizomes

from the previous crop, having 2-3 eyes, should be used for planting, since these produce the best-shaped ginger for curing. About 1,500 lb. are required to plant an acre. Covering with a mulch of straw, 4,500 lb. to the acre, has been found among other advantages to increase the yield, especially if used in conjunction with 200 lb. per acre of sulphate or muriate of potash. Harvesting begins in December (in Ceylon) and proceeds in stages according to market fluctuations. Ginger can be stored for 7-8 months in a cool, well-ventilated room but frequent examination and the prompt removal of decayed pieces is absolutely necessary or there will be heavy losses. The normal yield is fourfold, but with good cultivation this can be doubled. Curing operations consist of drying and peeling and these are described, as are those for the preparation of turmeric.

1223. GRAHAM, J. A. 633.825
Ginger.

J. Jamaica agric. Soc., 1938, 42 : 89-91.

The ginger crop has a marked stabilizing influence in parts of Jamaica, the small planters depending on it in February and March to pay their taxes and other heavy financial calls. Local methods of cultivation and curing are described. A previous account by the same author dealing with these matters appeared *Ibidem*, 1936, 40 : 231-2, *H.A.*, 6, 913.

1224. WIGG, L. G. T. 633.832
The clove plant, *Eugenia aromatica* L. Nursery practices and estate planting.

Publ. Dep. Agric. Zanzibar 1 of 1937, pp. 63, 5s.

This is a detailed account of clove cultivation in Zanzibar, containing many points of practical interest particularly to local cultivators of this plant. Certain cultural instructions dealing with the nursery may be noted. In raising young plants the seed should be obtained from trees of known high yield, though it is not yet certain to what extent such characters are inherited. It seems likely, however, that the clove can be self-fertilized and if the buds are picked early from the trees surrounding the parent the chances of a pure strain are increased, though cross-fertilization by distant wind—and insect-borne pollen would still be possible. The inferiority of self-sown seedlings compared with nursery-grown seedlings as planting material is emphasized and the different root systems of the two are illustrated. Good seed should be a fresh olive green with little or no red, should weigh less than 500 seeds to the lb., be free from insect damage, the radicle tips not blackened and the seed derived from single-seeded fruits. The number of good seed to be expected from 1,000 fruits is about 450. Up to 96% germination is obtainable from properly selected seed. The clove seed must not be buried in the soil when sown but must be placed in open drills, radicle downwards and covered with loose leaf litter to maintain moisture. The age for transplanting is from 12-17 months ; plants to be moved should be lifted with a ball of soil wrapped in banana leaf, possibly a month in advance and stood close together in trays ; a new and very fibrous root system will have resulted by planting time.

1225. VON BLÜCHER, G. L. A. 633.88.51
Anbau der Chinarinde (*Cinchona*) in Niederländisch-Indien. (*Cinchona*
cultivation in Dutch East Indies.)
Tropenpflanzer, 1938, 6 : 231-45.

The main points in the cultivation of cinchona trees are discussed, notes being given on geographical and climatic conditions, soils, propagation, nursery and plantation practices, pests and diseases and their control. Quinine production from an economical viewpoint is considered. Propagation by means of cuttings is stated to be very rarely used in practice. *Cinchona succirubra* is chiefly raised from seeds, and *C. Ledgeriana* either propagated sexually or vegetatively on *C. succirubra* stocks. Grafted cinchona trees are generally used on poor soils or soils exhausted by previous crops of cinchona.

1226. OZEROV, G. V. 633.88.51-1.415

Soil reaction and cinchona yields. [Russian.]

Soviet Subtropics, 1938, No. 6 (46), pp. 56-7.

The effect of fertilizers and stimulants on *Cinchona succirubra* plants was studied by the author in 1936.* The main object of the 1937 trials was to find soil pH values giving maximum cinchona tree yields. The plant material used were cuttings rooted in April 1937. There were 8 replications and the trials were conducted on light clayey soil with a slight admixture of gravel having the following pH values: 6.1, 6.5, 6.9, 7.3, 7.6, 8.0 and 8.6. Optimum soil acidity was found to lie somewhere between pH 7.3 and 8.0. The author concludes that increase in yield must be essentially attributed to an improvement of the physical structure and chemical composition of the soil due to decreased acidity resulting in bacterial development, extensive nitrification and absorption of anions by the plants.

1227. VOLLEMA, J. S. 633.912-1.541.11

Veredeling van *Hevea*. (Hevea selection.) [English summary.]

Landbouws, 1937, 13 : 482-6.

It is stated here from data which are discussed that the rootstock of budded *Hevea* usually has an unfavourable influence on the tree due it is thought to the anatomical differences between the tissues of stock and scion. Growth and yield are both benefited, however, when seedlings of vigorous high yielding strains are used as rootstocks.

1228. WINKLER, H. 635.952.2 : 634.1/8

Welche Pflanzen liefern tropisches und subtropisches Obst? (Tropical and subtropical plants bearing edible fruit.)

Tropenpflanzen, 1938, 8 : 325-42, bibl. 3.

The author gives an annotated alphabetical list of some 64 dicotyledonous families and 44 monocotyledonous families of plants growing in the tropics, many of the members of which are named as bearing edible fruits. The notes, though brief and not affording the same type of information in each case, are likely to prove useful for reference.

1229. HULSEN, G. 631.8 : 634.774 + 634.771 + 634.3 + 634.653 + 634.441 + 634.471

Die Düngung im Obstbau der Tropen und Subtropen. (The use of fertilizers in tropics and subtropics.)

Tropenpflanzen, 1938, 8 : 366-76, bibl. 6.

The amounts of N, P and K which the experiments of different workers have shown to be extracted from the soil and which must therefore be returned to the soil in the form of manures are noted for pineapple, banana, citrus, mango, mangosteen and avocado. The various recommendations are noted but are not discussed.

1230. GEHLSSEN, C. A. 634.3 + 634.771 + 634.653 + 634.774

Erfahrungen im brasilianischen Obstbau. (Fruitgrowing in Brazil.)

Tropenpflanzen, 1938, 8 : 342-65.

In this paper a concise account is given of the main features of orange, banana, avocado and pineapple growing in Brazil. *Orange*. The history of this crop in Brazil is followed by a description of the three main Brazilian varieties, *Citrus Aurantium asperma* Dulch (Bahia orange), *Citrus Aurantium pyriformis* Risso (Pera orange) and *Citrus Aurantium depressa* Risso (Selecta del Rio). The last named variety is preferred to the others on the inland market but is less suitable for export. Neither Bahia orange nor Pera are pure strains and there are many deviations from the normal forms. Such a one is Bahiniana, a dwarfing form frequently used for grafting dwarf trees and old trees. Certain advances have been made in breeding and selection

* See *Ibidem* 1937, No. 12 (40), pp. 79-81, *H.A.*, 8 : 240.

work. A certain amount of propagation from seed is done, great care being taken to obtain seed from healthy and typical trees which show resistance to *Phytophthora*. The sour and trifoliolate oranges, *C. Aurantium* and *C. trifoliata*, are often so raised for use as rootstocks. Rigorous elimination of weakly or non-characteristic trees is carried out in the nursery. Large and medium size seeds are preferred as giving higher percentage of viable seeds and better growing seedlings. Notes are given on grafting and pruning. Under the section devoted to pests and diseases, the measures recommended by Bitancourt of the Instituto Bialogico in Sao Paulo for the control of the most serious disease attacking the export orange crop, namely, *Phomopsis Citri* Fawc. Wolf. are described. At Limeira and Sorocoba (Sao Paulo) and at Nova Iguassu (Rio de Janeiro) packing houses have been constructed by the Brazil Government after the American model. Here the fruit is graded and packed according to government regulations. Export statistics are shown.

Banana. This fruit occupies the second place in fruit exports from Brazil, but its importance as a native food product is even greater than that of the orange. The main Brazilian varieties are described and a more detailed description is given of the dwarf banana, *Musa Cavendishii* (Port), which is stated to have several advantages over other varieties. Conditions generally favouring the cultivation of bananas in Brazil are discussed. Three stages in the development of the banana in Santos are noted. These are :—the period from planting to the time of shoot development, lasting 15-35 days; the period from shoot development to flowering, lasting 225-375 days; and the period from flowering to harvest, lasting 95-125 days. The first yield on newly laid out banana plantations can be expected after 12-18 months. On well-tilled, fertile soils, after the first cropping 3 shoots should be left to form 12 months later 3 further hands. After the second crop the stand should be thinned thoroughly and only one new shoot on each plant should be allowed to grow. On a plantation where such a practice is adopted one hand per plant can be expected from the third year onwards. Grading methods are described and figures are given showing the number of hands exported in 1936 and 1937.

Avocado. Certain data and descriptions are given of the following varieties: Waldin, Trapp, Gottfried, Puebla, Nimlioh, Collinson, Fuerte, Winslow, Wagner, Linda and Lulu. Avocado is said to be the only dessert fruit to contain easily digestible fats and thus it produces double the energy of fruits with equal amounts of carbohydrates. Notes are given on the preparation of oil from this fruit. Avocado oil contains large amounts of vitamins A, D and E and phytosterol and lecithin. The oil is of excellent keeping quality. Laboratory trials show that it may be kept for over 12 years at 5° C. without becoming noticeably rancid.

Pineapple. In North East Brazil planting is done in the rainy season (May-July) and the first crops can be expected in 15-18 months, i.e. in the dry season of the following year (October-December). After the first yield every plant forms a few new shoots which again bear fruit, provided all stolons are previously removed. Thus in Brazil two yields may be obtained from one crop. Plants are usually grown in double rows at a distance of 75 cm. between these rows, and 150 cm. between each pair of double rows. Of the pineapple varieties *Ananas pyramidalis* Bent is the variety most commonly grown in north east Brazil and Rio de Janeiro Province, while in the south *Ananas sativus* Schult. is more widely cultivated. Processing of the fruit is briefly mentioned and the export trade and Government regulations are discussed.

1231. STEPHENS, S. E.

588.427

Some tropical fruits. XVI. The granadilla.

Qd agric. J., 1937, 48 : 181-8.

Two varieties are known by this name in Queensland, viz. *Passiflora quadrangularis* and *Passiflora macrocarpa*, the former being of greater commercial value, the latter being favoured for the garden. The plant is essentially tropical and cannot stand frost. It is propagated either from seed or cuttings, the latter method resulting in more rapid fruit production. Cuttings are taken from lateral growth, should be not less than 15 in. long and preferably 2 or 3 ft. long. The cuttings strike more readily in the tropics if the leaves are allowed to remain on the above ground portion, which should be from one-third to a half the total length of the cutting. The lower part, with leaves removed, should be set horizontally or diagonally in a bed of well-prepared

loam, in its permanent position at the foot of a trellis post. It is a common practice to put two cuttings in each hole in case of failure. The vines are grown over a trellis support, the posts of which are set 10 ft. apart in two lines also 10 ft. apart. Strong frames of split rails or heavy sapling are supported on the posts, cross rails connecting them at 4 ft. intervals. Galvanized wire of 8 gauge is then run along the trellis, over the rails at 15 in. intervals, thus forming a horizontal network. The whole is known as a granadilla shed. Originally planting is done at every post, but later thinning may be done by removal of plants at every alternate post. Sometimes artificial pollination is necessary. The dying back of the lateral growths after crop production eliminates the necessity for much pruning. Experimental data on the manuring of the plant are absent, but it is thought that ordinary passion fruit treatment would probably be suitable, e.g. a 7-10-10 mixture containing nitrate of soda, blood and bone, superphosphate and sulphate of potash. The worst pest is the green vegetable bug (*Nezara viridula*) which punctures and sucks the young fruits. The control recommended for this is 10 lb. resin, 2 lb. caustic soda, 3 lb. fish oil and 40 gallons water. Fruit may be protected from other insect pests by enclosure in brown paper or possibly cellophane bags. Diseases so far have not proved serious.

1232. KHUTSISHVILI, G. Z., AND SCHLEIFELD, S. A. 588.83

Feijoa cultivation at the Batum Botanical Garden. [Russian.]

Soviet Subtropics, 1938, No. 8-9 (48-9), pp. 54-5.

In 1928 a *Feijoa Sellowiana* plantation, consisting of 200 1½ year-old plants, was laid out at the Batum Botanical Garden for the purpose of studying the best methods of cultivation. Records were taken of vegetative growth, yields, flowering, fruiting and response to fertilizers.

1233. STEPHENS, S. E. 634.422

Some tropical fruits. XVII. The rose apple.

Qd agric. J., 1937, 48 : 726-7.

The rose apple (*Eugenia Jambos* L.) belongs to the *Myrtaceae* and is indigenous to India and Malaya. It was probably introduced into Queensland some 40 years ago. The ripe fruit is very similar to that of the common guava but is not so highly flavoured or so palatable. The fruit is, however, highly scented, being compared to a highly scented rose. It is sometimes referred to as *Caryophyllus Jambos* Stokes or *Jambosa vulgaris* D.C. and is known in India and Malaya as Jambu.

1234. STEPHENS, S. E. 634.431

The sapodilla.

Qd agric. J., 1937, 48 : 340-1.

At present the author knows of only 1 large and 3 small trees of sapodilla (*Achras Zapota*) in Queensland. The large tree, though now 20 years old, has as yet not fruited. The sapodilla belongs to the *Sapotaceae* and is a native of tropical America. Although regarded as one of the best indigenous tropical fruits of America, its cultivation has not been undertaken extensively in other countries, possibly by reason of the difficulty of vegetative propagation and of its slow growth. [With regard to propagation see, however, *Vegetative propagation of tropical and subtropical fruits. Tech. Comm. Imp. Bur. Fruit Prod.*, 7, 1936, pp. 18, 19.—ED.] Other names are "chico" and "naseberry".

1235. STEPHENS, S. E. 634.45

Some tropical fruits. XV. The mabolo.

Qd agric. J., 1937, 48 : 57-9.

The mabolo (*Diospyros discolor*) belongs to the *Ebenaceae*. It is slow growing and reaches a height of 30 feet. Its chief value lies in its ornamental appearance, as the fruit has a distinctive but not extremely palatable taste, at least among the varieties known in Queensland. Its native habitat is the Philippine Islands and the East Indies. It is normally raised from seed, which germinates readily in loamy sand, though Wester has propagated it vegetatively by shield budding in the Philippines. Other names for it are "velvet apple" and "butter fruit".

1236. JODIDI, S. L. 581.02 : 634.58
Preliminary biochemical studies on effects of certain environmental factors on development and composition of the pea nut.
J. agric. Res., 1938, **57** : 301-11, bibl. 18.

Observations were made on the chemical composition of the fruits of two varieties of peanut which had received different nutritional treatment, and an attempt is made to correlate the application of nitrogenous manuring and of bordeaux spray with the following constituents of the nuts : ash, oil, protein, crude fibre and carbohydrates.

1237. JENKINS, W. A. 634.58-2.4
Two fungi causing leaf spot of peanut.
J. agric. Res., 1938, **56** : 317-32, bibl. 7.

The morphology and life history of the two peanut leaf spot fungi *Cercospora arachidicola* Hori and *C. personata* (B. and C.) E. and E. as observed over 3 seasons are here described. The following names are proposed for the perithecial stages of these fungi : *Mycosphaerella arachidicola* sp. nov. for the former and *M. Berkeleyi* sp. nov. for the latter.

1238. BRÜCKMANN, J. H. 634.6
 Salakcultuur en -handel in Noord-Jogjakarta. (**Cultivation and marketing of salak in North Jogjakarta, mid-Java.**) [English summary.]
Landbouw, 1938, **14** : 436-445.

The salak (*Salacca edulis* Reinw.) is a dioecious palm cultivated for its fruits in Java. There are 3 principal varieties, of which the heterogeneous salak pondoh is usually raised vegetatively from offsets, the other varieties being mainly seed grown. Suitable offsets for propagation are from 3 to 6 months old. They are induced to root by encasing them below ground in a petroleum tin with one side cut open to admit the offset stem. When the offset stem is in position the tin is filled with prepared soil and covered with earth. The tin will be full of roots in about a year when the sucker can be detached and planted out. Care must be taken to avoid excessive root disturbance, and shade is necessary. Without proper precautions the mortality among plants so raised is high. No manure is given but irrigation is practised if possible. Irrigated orchards produce about 400,000 fruits per hectare per annum, whilst non-irrigated gardens yield about 280,000 fruits. The fruit takes 6 to 7 months to develop.

1239. TAMMES, P. M. L. 581.162.3 : 634.61
 Over den bloei en de bestuiving van den klapper. (**On the inflorescence and pollination of the coconut.**) [English summary.]
Landbouw, 1937, **13** : 74-89, bibl. 11.

The structure and development of the inflorescence of the male and female flowers are described in detail. Under conditions at Manado, Dutch Indies, pollination is effected mainly by insects. Methods of artificial selfing and crossing are described.

1240. TAMMES, P. M. L. 634.61-1.55
 Over de factoren welke de vruchtdracht van den klapper bepalen. (**Factors determining yield of coconut palms.**) [English summary.]
Landbouw, 1937, **13** : 260-9, bibl. 11.

The number of nuts produced is shown not to be limited by the number of flowers, nor by pollination but to be exclusively controlled by factors concerned in the nutrition of the palm. Water is of much importance, the detrimental effects of an intensive drought being often observable two years later. Two months after the female flowers have opened nut fall ceases so that the number of unripe nuts provides a reliable estimate of the crop to be gathered during the next ten months.

1241. TAMMES, P. M. L. 634.61-2.4
 De bestrijding van de bladvlekkenziekte bij jonge klappers. (**Control of blight on young coconuts.**) [English summary.]
Landbouww., 1937, 13 : 69-73, bibl. 8.

Grey spot or blight of young coconuts can be kept in check if the young plants are lightly shaded for the first two years. Native methods in Java are to provide shade by growing maize on the site but failing this shade may be provided by planting cuttings of *Sesbania grandiflora*. Heavy shade is harmful. If the blight follows insect attack the pest should be controlled.

1242. BROWN, J. G. 634.62-2.48
Inflorescence blight of the date palm.
J. agric. Res., 1938, 57 : 313-8, bibl. 7.

The blight attacking the inflorescence of date palms in Southern Arizona is found to be caused by two *Fusarium* species. It is suggested that the first step in control should be the removal of all staminate flower clusters after pollination has been completed and the removal of all pistillate rhachis after the fruit has been harvested. This should be followed by a thorough spraying (copper acetate, lime-sulphur or bordeaux 4-4-50) before the spathes break open.

1243. BARNETT, G. B. 634.651
The papaw or papaya.
J. Dep. Agric. W. Aust., 1938, 15 : 21-9.

The article describes the approved methods of growing papaya. These are generally well known and need not be abstracted. Reasons for crop failures in Australia apart from climatic causes, insect attack or disease may be due to excessive watering or manuring, especially at fruit setting or to lack of pollination. Infertile fruit is usually insipid and with a thin leathery skin. Apart from the usual method of sowing seed propagation may be effected by cuttings of small branches taken so as to include the natural swollen growth at the point of union with the parent. Grafting can also be done with fair success, but the parental qualities are not always maintained and, as also in plants from cuttings, the age of the parent seems to be transmitted to the scion. There are also some notes on packing, emphasis being laid on the importance of careful handling, the slightest bruise at harvest developing into an unsightly patch by the time the market is reached.

1244. BARNES, H. 634.651
The papaw. I.
Qd agric. J., 1937, 48 : 480-7.
 GREGORY, J. H. 634.651-1.564
The papaw. II. Harvesting, packing and marketing.
Ibidem, pp. 487-94.

Bisexual varieties are preferred, the New Guinea or Long Tom and the Cowleyi or New Era and modifications of these two varieties being most largely grown in Queensland. Seed is sown in early spring in specially prepared seed beds subjected to partial shade. If the beds are kept well watered the young plants will soon appear. When 8 to 12 inches high they are transplanted to their permanent positions. When planting out the foliage except the young undeveloped crowns must be removed to reduce evaporation. By foliage is meant only the leaf blade, the petiole or leaf stalk remaining, since the removal of the latter in the green state at any stage allows the entry of pathogenic fungi. In the seed bed a wide variation in vigour will be noticeable and the more strongly growing plants can be weeded out as being invariably males.* It should thus be possible to get a very high percentage of female plants. In planting out it is recommended that 2 or 3 plants should be planted 2 or 3 inches apart in one hole and allowed to grow. When the flowers appear the males and all except one female are removed. Spacing of 8×8 ft. allows of 680 plants to the acre and of horse cultivation between rows. II. Care must be taken to pick at the correct stage of maturity. Fruit can be allowed to colour more in winter than in summer without affecting its carrying capacity. Summer conditions

*Cf. however abstract 1358.

need more care. The firmer fleshed type is preferable for sending to distant markets. The best container is the tropical fruit case $24\frac{3}{4} \times 12 \times 12$ inches and woodwool is the best packing material. Details of packing to ensure maximum protection on long journeys are given. The hardest part of the fruit which is the stalk end should, as far as is possible, face outwards, i.e. to the side of the case. Packing for local markets is simpler.

1245. SIMMONDS, J. H.

634.651-2.1/4

Diseases of the papaw.

Qd agric. J., 1937, 48 : 544-52.

The author deals with the following diseases :—*Black spot*. This is due to a fungus *Ascochyta Caricae*. It affects all the above ground parts of the plant except the leaves. Control has not yet been worked out. It is suggested that the choice of warm sheltered positions for planting and adequate manuring, especially of potash when the plants are in fruit, should help to prevent it. *Powdery mildew* (*Sphaerotheca* sp.). This attacks only the younger parts of the plant. It is mainly a winter trouble. Dusting with 50% sulphur dust containing lime as a filler or spraying with lime sulphur, if black spot is also present, is recommended. *Ripe rots*. These fruit rots are caused by *Ascochyta Caricae* and a species of *Gloeosporium*. Selection of warm position, proper manuring and orchard hygiene should hold this in check. A sulphur spray during winter and spring is also recommended if powdery mildew is also present. *Watery rot*. This disease of picked fruit is due to *Rhizopus nigricans*. Its incidence is generally connected with some old injury such as black spot lesions. Sanitary precautions in plantation and packing shed are necessary. *Foot rot*. The rot is caused by *Pythium ultimum* and occurs on the roots causing wilting and death. It results from loss of aeration in waterlogged soil. Affected plants should be dug out and burned and replanting should not be in the same hole. *Yellow crinkle*. This disease is more prevalent under drought conditions. The leaves show a yellow colour and the petioles droop. Gradually the older foliage drops leaving a bare stem crowned with a few misshapen leaves. The floral parts, if present, may also develop abnormally into foliage-like structures. It is possibly due to a virus. Removal with the usual sanitary precautions would appear to be the only course of action. *Dieback*. This phenomenon is probably physiological. It occurs in dry seasons when soil moisture is low. Careful irrigation is suggested as a preventive.

1246. SMITH, J. H.

634.651-2.6/7

Insect and allied pests of the papaw.

Qd agric. J., 1938, 48 : 553-7.

The following pests and their control are discussed :—Red spider (*Tetranychus telarius* L.). Control lime sulphur spray or sulphur dust. Papaw bugs. The two most serious bugs are the fruit-spotting bug (*Amblypelta lutescens* Dist.) and the green vegetable bug (*Nezara viridula* L.). Hand picking is the only remedy suggested. Yellow peach moth (*Dichrocrocis punctiferalis* Gn.). The worst damage is done by larvae at the growing point. No control method is worked out at present. Nematodes. Failure due to nematodes is primarily a sequel to starvation following root injury. Adequate manuring is essential and sanitary measures in the orchard afford the best preventive. Other pests mentioned are the Queensland fruit fly (*Choetodacus tryoni* Frogg.), fruit sucking moths such as *Othreis fullonica* L. and *Eumoenas salaminia* F., and Jassids (*Jassidae*).

1247. LAL SINGH AND SHAM SINGH.

634.668

Pruning of fruit trees. The effect of dormant pruning on cropping and vegetative vigour of phalsa (*Grewia asiatica*).

Indian J. agric. Sci., 1938, 8 : 319-30, bibl. 8.

Phalsa is a tree indigenous to India and is now attracting attention because of its edible fruits and attractive light purple juice which is becoming a popular summer drink. From the cultivator's point of view it is easily accommodated as regards soil, water and manurial requirements and the initial cost of planting up is negligible. The fruit is borne in the axils of new growth.

For this reason the pruning method in the Punjab has been to cut the tree down practically to ground level annually during dormancy. Pruning experiments were started, the seedlings being planted in 1928, at Lyallpur, the first prunings being given in 1931. The methods used were the normal or heavy pruning, a medium pruning whereby the trees were headed to 1½-2 ft. above ground and a light pruning or heading the trees to 3½-4 ft. above ground. Of these the light pruning over a period of 6 years gave outstandingly the best yields and the method is recommended for adoption. The unpruned bushes also produced innumerable shoots, but these were weakly from overcrowding and only fruited sparsely. The size of the fruit increased with severity of pruning but at its best by no means compensated for the numbers lost by heavy pruning. There is a high positive correlation ($r=0.58$), between the number of new shoots and yield in the case of pruned bushes and it is most marked in the case of light pruned bushes. Its practical significance is that new growth of a certain vigour only would be sufficient to give the desired performance. This can be effected by adopting suitable pruning methods in orchard practice. Other things being equal, the severer the pruning the smaller will be the yield, the less the number of new shoots, and the larger the size the worse will be the quality of the fruit.

1248. EASTWOOD, H. W.
Winter work in the banana plantation.
Agric. Gaz. N.S.W., 1938, 49 : 383-4.

634.771

The winter work applies to banana groves situated in the colder districts. Weeds are cut down and the dead leaves stripped from the plant. The idea that if left hanging down around the plant they serve as protection against cold is out of favour and it is considered that the access of sunlight and air is more important. Tight soils must be dug once a year to improve aeration. Weak yellow plants often seen on hill sides are not suffering from bad drainage but from bad aeration of the soil. Digging here means working the soil with a three pronged fork hoe or with a mattock. In past experience, should the grove become chilled it has been found essential to cut down all plants to the ground and to let small suckers in the stools grow up and replace them. It is difficult to decide to destroy those stems which have apparently survived unharmed, nevertheless they will, if they remain, only produce unmarketable fruit.

1249. TANAKA, Y.
Studies on the effect of three fertilizing elements upon the banana plant.
 [Japanese, English summary 19 lines.]
 Reprinted from *Hort. tropic.*, 1937, 7 : 421-31, bibl. 5.

634.771-1.82/5

In 1932-5 manurial trials were made with bananas grown in sand in pots. The variety used was Hokushō. The following conclusions were reached: Nitrogen proved to be the most important fertilizer and its omission resulted in very poor growth. The effect of omitting potassium became evident only after some time, but it was then observed to cause a continuous decrease in vigour of older plants. Omission of phosphorus was found to have only very slight effect on stem growth, but it resulted in a very poor root development.

1250. WARD, F. S.
Cercospora leaf spot of bananas.
J. Jamaica agric. Soc., 1938, 42 : 23-34, bibl. 4.

634.771-2.48

Cercospora leaf spot of bananas, though well known in the Far East and Australasia since 1913, first appeared in the American tropics in 1933-4. The causal organism first described, from Java, in 1902, is *Cercospora Musae*. In Jamaica there are three types of infection known as severe, moderate and mild. These are described. The disease is commonly found on three different soil types in Jamaica, none of which are recognized as first class banana land, maximum damage being caused under conditions conducive to the spasmodic, rapid, succulent growth of the host plant alternating with a less vigorous growth in dry weather. It is pointed out that on clays and good loams, in other words on good banana soils, the disease is ineffective, even when these

soils have been growing bananas for 50 years. A series of spraying and dusting experiments are described, and though results are sometimes contradictory, the indications are that good control can be obtained by the use of 1% I.C.I. Compound (cuprous oxide) at the rate of 250 gallons per acre at 3-weekly intervals. Bordeaux spraying is probably less effective; 1% concentration (4:4:40) at 3-weekly intervals at the rate of 200-250 gallons per acre gave a better leaf appearance but with the fruit not so well filled out as with $\frac{1}{2}$ % concentration applied at the same rate. Undoubtedly the best fruit is obtained following the I.C.I. Compound but the price is said to render the commercial use of this spray impossible. Dusting with I.C.I. Dust Compound and bordeaux mixture dust both afford an equally effective means of control with milk powder as a sticker. The ripening of infected bunches in cold store was normal. The common plantain, *Musa paradisiaca*, in Jamaica, as in Ceylon, shows considerable resistance to this as to other diseases.

1251. CALDWELL, N. E. H.

634.771-2.73

Banana rust thrips control.

Qd agric. J., 1937, 48 : 392-9.

The author outlines measures for controlling the banana rust thrips (*Scirtothrips signipennis* Bagn.) designed for conditions in the southern part of Queensland. Selection of planting material should be from plantations where rust is unknown or very slight. Recent experimental work has shown that bagging and dusting of the bunch provide a satisfactory economic method of rust control on a bearing plantation. Briefly the procedure is as follows. The bunch is enclosed as soon as possible after it has emerged in a good quality 11 oz. hessian bag about 45 in. deep by 27 in. wide. The mouth is fastened securely above the top hand by string, wire or nail. A fortnight later it is taken off, fallen bracts emptied out, persistent bracts removed from the bunch, the "bell" broken off and the bag replaced. This operation minimizes risk of fungal infection. During the active season of the thrips nicotine dust (nicotine content not less than 2%) of a light fluffy type, is applied at fortnightly intervals, starting at the time when the bag is first put on and continuing throughout the life of the bunch, or alternatively is applied at weekly intervals for a month after the bunch is thrown, dusting being then discontinued. All dustings except the first are given through a small hole in the bottom of the bag. Most dust guns will be found to give normally an excessive amount of insecticide and must be regulated to give less. Excessive dusting necessitates cleaning before packing. Other methods said to give a fair measure of control are dusting weekly with a nicotine dust without bags, and applying nicotine dust fortnightly under cover of a hessian cloak. Notes are given on the time at which control measures may be necessary and on cultural practices which should be considered in rust control. The bagging of bunches has other excellent effects on the fruit produced—e.g. even maturity, elimination of sunscald, reduction of cracking in mature fruit, elimination of damage from incidental pests, etc. Although bagging results in rather pale coloured fruit, this does not prejudice marketing.

1252. LEWCOCK, H. K.

634.774-2.8

Yellow spot disease of pineapples.

Qd agric. J., 1937, 48 : 665-72, bibl. 6.

The yellow spot disease of pineapple is a virus transmitted by *Thrips tabaci* L. It was first reported in Queensland in October, 1937, although it has been known and identified elsewhere in Hawaii and the Philippines for some 10-12 years. The author gives Illingworth's description of the disease and discusses the role played by *Thrips tabaci* and by climate in the spread of the disease. Complete eradication by grubbing does not appear possible owing to the disease living also on a number of weed hosts, such as *Emilia*. The only palliatives at present used in Hawaii are planting only slips or suckers, which reduces losses among young plants to negligible proportions and cutting off infected tops directly the disease makes its appearance and thus avoiding fruit losses. So far attempts to control the disease by biological control of the thrips has failed in Hawaii owing to the failure to establish counter parasites on an adequate scale.

1253. TIDBURY, G. E. 635.23 : 632.8

A note on the yield of mosaic-diseased cassava.*E. Afr. agric. J.*, 1938, 3 : 119.

A note of experiments at the Kizimbani Experiment Station, Zanzibar, with 3 local varieties of cassava. It was found that wholly mosaic-diseased cassava yielded very much less than partly diseased or healthy cassava. There was no significant difference between the yields of the two latter categories. Based on these findings, which confirm those obtained by the Department of Agriculture, Nigeria, in 1936, it is suggested that after 3 months in the field roguing should be confined only to wholly infected plants, though prior to that period it might be advantageous to rogue and replace by clean cuttings all plants showing traces of mosaic. Trials on this point are in progress.

1254. STOREY, H. H., AND NICHOLS, R. F. W. 635.23 : 632.8

Virus diseases of East African plants. VII. A field experiment in the transmission of cassava mosaic.*E. Afr. agric. J.*, 1938, 3 : 446-9.

Forty-eight square plots each to hold 9 plants were laid out at Amani and each surrounded with a hedge of mosaic-diseased cassava so that every experimental plant except the centre one was in contact with diseased plants. In each plot one healthy clonal cassava plant was established at the beginning of each month for two years. Healthy survivors, being mature, were removed every 8 months. Plantings made in June survived unaffected for the longest time, while May, July and August were also favourable planting months. All plantings from December to April were diseased after 3 months growth. Even in the best period, May and June, well over 50% of the plants became diseased. Statistical analysis indicates no variation of susceptibility with age.

STORAGE.

1255. D.S.I.R.,* LONDON. 664.84/5

Report of the Director of Food Investigation for the year 1937. Section VIII—Engineering.*Rep. Fd Invest. Bd, Lond., for 1937*, 1938, pp. 211-61.

Among articles dealing with engineering aspects of storage the following are of particular interest to fruit growers and transporters. Gane, R., Tainting and the volatile products of oranges 2 pp.; Gane, R. and Smith, A. J. M., Water relations of seeds 9 pp.; Hardy, J. K., The cooling of strawberries 8 pp.; Hardy, J. K., The gas storage of Cox's Orange Pippin apples on a commercial scale 3 pp.; Hardy, J. K., Work in the experimental hold [at Ditton] 26 pp.

1256. UNION OF SOUTH AFRICA, DEPARTMENT OF AGRICULTURE,
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- DIVISION OF PLANT INDUSTRY. 664.85

Report of the Low Temperature Research Station Laboratory, Capetown, for the year June 1935-June 1936, 1937, pp. 215.

Reports are made of the following activities: East London pre-cooling store pp. 11-33, copiously illustrated with photos and diagrams. Pre-cooling of fruit pp. 34-6. Temperature recorders for ships' holds, pp. 36-8. Rail transport of fruit—citrus fruit temperatures in transit, pp. 39-45. Fruit transport in refrigerated trucks, pp. 46-69. Cold storage of plums,† pp. 69-129. Cold storage of peaches,† pp. 130-160, bibl. 13. Gas storage of Kelsey plums,† pp. 160-7. Grape wastage investigations,† pp. 167-87. Drop berry in Waltham Cross grapes,† pp. 187-99. The use of maleic acid as a ripening inhibitor for deciduous fruits,† pp. 179-215.

* Department of Scientific and Industrial Research.

† See separate abstract.

1257. WARDLAW, C. W., LEONARD, E. R., AND WATTS, C. T. 664.85.037
The low temperature research station (1937).
Trop. Agriculture, 1938, **15** : 179-82, bibl. 2.

This copiously illustrated description of the refrigerating plant and buildings at the Low Temperature Research Station, Trinidad, has as its object the recording of the major changes effected during the reconstruction of 1936-7. Later it is proposed to issue a paper in which the detailed functioning of the Station in terms of physical measurement will be set forth.

1258. ISAAC, W. E. 664.85 : 547.476.2
The use of maleic acid as a ripening inhibitor for deciduous fruit.
Rep. Low Temp. Res. Sta. Lab., Capetown, for the year June 1935-June 1936, 1937, pp. 199-215.

The experiments reported here are of a preliminary character and the report made should be regarded as an interim report. So far results support Copisarow's claim that maleic acid retards fruit ripening (*J. Pomol.*, 1936, **16** : 9-18, *H.A.*, **6** : 405), but unexpected difficulties of procedure were experienced, especially in relation to skin injuries caused by amyl acetate and other esters and by the oils of orange and lemon.

1259. TOMKINS, R. G. 664.85.038
Treated wraps for the prevention of rotting.
Rep. Fd Invest. Bd Lond. for 1937, 1938, pp. 161-2, bibl. 3.

The following classes of compounds have been investigated: The higher aliphatic alcohols, phenols, organic acids, benzoic acid derivatives, hydrocarbons, chloro and other derivatives of hydrocarbons. The survey made of the action of the above leads to the conclusion that most slightly volatile fungicidal compounds when incorporated in wraps do not retard rotting of fruit. The compounds which appear to produce least injury are some of the hydrocarbons and their chloro and chloro-nitro derivatives. These, however, cause tainting.

1260. FARKAS, A. 664.85.3.038
The practical application of impregnated wrappers against fungal decay of citrus fruit.
Hadar, 1938, **11** : 261-7, bibl. 19.

As a result of trials which are described in detail the use of wrappers impregnated with diphenyl is suggested for Palestine grown citrus. The financial as well as the technical and practical aspects are discussed.

1261. KESSLER, H., AND STÄHELIN, M. 664.85.11.021
Ergebnis der Versuche mit direkter Imprägnierung an Tafeläpfeln. (Experiments with wax-preserved dessert apples.)
Schweiz. Z. Obst- u. Weinb., 1938, **18** : 342-8, bibl. 5.

The effect of impregnating agents on dessert apples during storage has been studied for several years at Wädenswil and Lausanne. Different waxy materials were used including Cirefruit (Widmer), Fruco (Wehrli) and Wädenswil No. 6 and No. 8, and of these the last named proved the most uniformly successful. The following conclusions were reached: The loss in fruit weight due to evaporation of water was considerably reduced and consequently treated fruits shrivelled less than untreated fruits. None of the coating agents reduced rotting and the process of ripening, which depends on the storage temperature, was also not affected. The fruits were coated quickly and easily by means of a Wehrli-machine with a capacity of approximately 1,000 kg. fruits per hour. This method was found to be especially valuable in storing varieties which normally tend to shrivel such as Boskoop, Canada Reinette and others particularly in

dry storage atmospheres. Similar results were also obtained by the use of oiled wraps. The further development of such treatment depends on the attitude adopted by the market and the consumer.

1262. PIMENOVA, A. S. 664.84.13 : 632.952

Professor Zbarsky's bactericide for the control of diseases of fruit and vegetables in storage. [Russian.]

Fruits and Vegetables, Moscow, 1938, No. 8-9, pp. 30-4.

In the search for effective fungicidal sprays preventing deterioration of fruit and vegetables in storage, among other chemicals the effect of water solutions of Zbarsky's bactericide (which is successfully used in medicine) on carrots, potatoes, onions and mandarins was studied by Glavtorgplodoovoshch (Commercial Centre for Fruit and Vegetables). In the present article similar experiments with carrots are described in some detail. The results may be summarized as follows:—By exposing the carrots for 5 minutes to the fungicide (1:10,000) rotting was reduced by approximately 50%. The vitality of the roots was not impaired by the use of the fungicide at this concentration. This bactericide is considered particularly useful for treatment of seed carrots, although it may be also used otherwise. The requisite length of treatment and strength of concentration have not been finally fixed for any particular crop or any particular fungus. The treatment is said to offer no practical difficulties and to be inexpensive. Directions on the use of the bactericide (concentrations, exposures, etc.) may be obtained from the following address:—Moscow, 52, Karacharovo, 122, Fruit and Vegetable Research Laboratory of Glavtorgplodoovoshch, U.S.S.R.

1263. HOBLYN, T. N. 664.85.11

A study of the variation in keeping quality of apples in store : as illustrated by the behaviour of the variety McIntosh Red from an Ontario apple orchard.

Reprinted from *Supplement to J. roy. statist. Soc.*, 1938, 5 : 129-70, bibl. 24.

The value of this interesting paper is increased by the discussion on it conducted by statisticians and horticulturists, which is given in full. The author summarizes his results as follows:—An experiment carried out on McIntosh Red apples in Ontario in the season 1936-7, designed to throw light upon causes of variability in the keeping quality of stored fruit, is described. Six samples of 60 apples each were obtained from each of 32 trees in a commercial orchard. The trees were selected to show the effect of differences in position in the orchard and of degree of winter injury. Two of the 6 samples were selected from the trees at random ; the other 4 consisted of 12 sub-samples of 5 apples each, taken to represent different categories for size, colour and position of the fruit from each tree. Apples from 16 trees were stored at a temperature of 36° F. in one room and apples from the other 16 in a similar room at a temperature of 32° F. The samples were so arranged that 1 sample from each of the 16 trees was placed in each of 4 blocks occupying different positions in the rooms. The fruit was removed in June 1937 and records obtained of core-flush, scald, fungal rotting, shrivelling, etc. The data for core-flush and scald are analysed and the effects of the various factors in the experiment are shown. In room 32° F. there was a considerably greater amount of both core-flush and scald than in room 36° F. Differences between trees in the orchard were very marked both in the random samples and in the graded samples, but the effects of position and of winter injury were not very clear, possibly owing to the limitations of the experimental design and available trees. There was a notable tendency for samples from the same tree to be more like one another than those from different trees, especially in the graded samples. Size, amount of red colouring, and to a less extent position on the tree all had an influence on core-flush, but only red colouring was of importance with regard to scald. The variation between samples is shown to depend to a large extent upon the average amount of core-flush or scald present in the samples, those with small amounts being much more variable than those with large. The distribution of the coefficients of variability obtained is compared with those expected for a binomial distribution. While evidently of a similar nature, those obtained were rather higher, the nearer to complete

homogeneity within a sample, the closer the approximation to the binomial curve. It is concluded that in designing an experiment to show fine differences, care must be taken to eliminate first the larger differences. Further, it is essential before the main examination is begun to fix carefully the level to which, on the whole, breakdown is to be allowed to proceed. Methods of sampling for use in certain contingencies are discussed in the light of the experience gained in this experiment.

1264. MINISTERIE VAN ECONOMISCHE ZAKEN, HOLLAND.

DIRECTIE VAN DEN LANDBOUW.

634.11-2.1

Handleiding voor het herkennen van eenige niet-parasitaire ziekten en beschadigingen van appels. (**The identification of non-parasitic diseases and injuries of apples.**)

Meded. Tuinbouw-voorlichtingsdienst, 7, 1938, pp. 49, bibl. 62.

The main causes of injury and non-parasitic disease on apples both on the tree and in storage are here discussed. Notes are given on fruit injury due to climatic factors, on physiological diseases caused by deficiency or excess of certain nutrients and by drought, as well as on certain storage conditions and treatments of the fruit which result in some form of injury or disease. Twenty-nine text figures are included.

1265. KIDD, F., AND WEST, C.

664.85.11 : 631.541.11

Northern Spy rootstock and keeping quality.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 172-3, bibl. 1.

Comparison was made of the keeping qualities of Grenadier apples on Northern Spy rootstock and on East Malling XVI rootstock. The fruit was picked on 17 August, 1936, from 15-year-old trees and stored at temperatures of 34° F., 37°, 40°, 50° and 70° F. Very little difference was found. In both cases 37°-40° proved the optimum temperature.

1266. KIDD, F., AND WEST, C.

634.11-1.8 : 664.85.11

Effects of manurial treatments on the keeping qualities of Cox's Orange Pippin apples.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 97-101.

This is the first report on a trial laid out to determine the effect of rootstock (types I, V, IX and XII) and of manuring on keeping quality of Cox's Orange Pippin apples. The 1936-7 season was the first in which a sufficiently large crop of fruit was available; even then only from trees on number IX stock was there enough fruit. 600 apples were graded into 30 samples of 20 fruits. Six samples were stored at each of the following temperatures:—34°, 37°, 40°, 50° and 60° F. and were not wrapped. The optimum temperature was found to be 40° F. at which temperature wastage was entirely *fungal*. From the data tabulated here it is clear that fruit from all treatments containing potash was of better keeping quality in this respect than that from treatments omitting potash. *Low temperature breakdown* occurred at 34° but not at 37° F. and at 34° F. potash had a pronounced effect in rendering the fruit susceptible to low temperature injury. There are also indications that the presence of nitrogen also makes the fruit more liable to this type of breakdown. *Scald*, though of no commercial interest in this trial, was shown to be prevalent in fruit that had received potash and the addition of phosphorus greatly increased this susceptibility. *Flavour*. The presence of potash appeared to be essential for good flavour.

1267. SMITH, W. H.

634.11 : 581.47 : 664.85.11

Anatomy of the apple fruit.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 127-33, bibl. 2.

In this article the author considers in turn the intercellular volume of the cortex of the apple fruit, the intercellular volume of varieties and the number of cells in the apple. A comparison shows that the summer varieties of apple, e.g. Beauty of Bath or Early Victoria, have the largest number of cells and highest rates of respiration and the winter varieties, e.g. Bramley's Seedling, the reverse. In a table are given data of the calculated number of cells per unit weight of cortex in relation to level of respiratory activity for 21 common English varieties.

1268. KIDD, F., AND WEST, C. 664.85.11

Individual variation in apples.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 114-5.

Observation on the apples of a Rome Beauty tree grown in a pot show that the climacteric rise occurs normally in apples attached to the tree and that the time of the onset of the climacteric varies with different fruits on the same tree.

1269. ZILVA, S. S., KIDD, F., AND WEST, C. 577.16 : 634.11

Ascorbic acid in the metabolism of the apple fruit.

New Phytol., 1938, 37 : 345-57, bibl. 10. [Summary only in Rep. Fd Invest. Bd, Lond., for 1937, 1938.]

Vitamin C is present in the apple, both as *l*-ascorbic acid (reduced form) and as dehydroascorbic acid (reversibly oxidized form). The total quantity of vitamin C present in these two forms remains constant, per unit of fresh weight, throughout the growth of the apple. There is, however, a change in the relative proportions of the two forms. As the fruit approaches maturity, the proportion of *l*-ascorbic acid increases and that of dehydroascorbic acid decreases. [Authors' summary.]

1270. HULME, A. C. 581.12 : 542.1 : 664.85.11

An apparatus for measuring the output of carbon dioxide by a sample of 2-4 kg. of apple fruits.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 133-6, bibl. 4.

A single Pettenkofer tube being incompetent to absorb all the CO₂ evolved at a rate of air flow sufficiently rapid to prevent accumulation of the gas in the respiration chamber, when dealing with 20-30 apples kept at a temperature of 12° C., an apparatus has been devised to do so. It is here described and illustrated and results achieved by its use are graphically shown.

1271. KIDD, F., AND WEST, C. 664.85.11 : 547.313.2

The effect of ethylene on the respiratory activity and the climacteric of apples.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 103-14, bibl. 3.

Experiments were carried out with preclimacteric Sturmer Pippin apples held at 45.5° F. Those treated with ethylene (1 in 500) for 1 to 5 hours exhibited stimulation followed by recovery. The climacteric occurred after 14 days as compared with 20 days in the case of the untreated fruit. Apples submitted to ethylene for 1 to 2 days showed stimulation without recovery. Exposure to ethylene at low temperatures (33.8°) for 1 hour or 1 day had no effect, exposure for 3 days produced stimulation without recovery. In other experiments fruits were taken to a low temperature and afterwards kept there at different stages. Those taken in the preclimacteric stage were treated with ethylene for 3 days after lowering the temperature. Effects on respiration are noted. In addition the action of ethylene in the presence of 10% CO₂ was tested. Results show that treatments up to two-day exposure to ethylene (1 in 1,000) produced stimulation followed by recovery. After one or two such recoveries from stimulation, further treatment produced stimulation without recovery.

1272. KIDD, F., AND WEST, C. 664.85.11.035.1

Spotting and other effects on apples in storage due to volatile products from ripe apples of other varieties stored with them.

J. Pomol., 1938, 16 : 274-9, bibl. 5.

As the result of previous observations which had shown the ill-effects of storing ripe post-climacteric apples with those of later maturing varieties further experiments were carried out. Worcester Pearmain and James Grieve apples in a yellow, ripe and greasy state with a strong aroma were placed in store on 4 October at 39° F. both in air and in gas (10% CO₂, 10% O₂ and 80% nitrogen) together with unripe Bramley's Seedling, King Edward VII and Laxton's Superb apples. In another cabinet (gas storage as above) no ripe apples were enclosed but ethylene at the rate of 1 in 500 was added to the atmosphere for 3 weeks. The apples were examined

on 31 January. The King Edward VII apples showed no spotting under any of the conditions of store. The Laxton's Superb apples were badly skin spotted with lesions originating at the lenticels both as the result of the inclusion of the ripe apples and of the ethylene. Bramley's Seedling apples showed severe spotting in all cases. In this case the spotting due to inclusion of the Worcesters was much more pronounced than that due to that of the James Grieses. The spotting due to the presence of the other apples was less pronounced in the wrapped than in the unwrapped fruit, but in the ethylene stored fruit wrapping made no difference. Little or no spotting occurred on the Worcester Pearmain or James Grieve apples during the storage.

1273. EZELL, B. D., AND GERHARDT, F. 664.85.11 + 664.85.13
Respiration and oxidase and catalase activity of apple and pear fruits.
J. agric. Res., 1938, 56 : 365-86, bibl. 45.

A considerable review of the available literature is followed by an account of recent experiments by the authors with Delicious (3 strains), Rome Beauty and Winesap apples and with Bartlett, Anjou and Bosc pears. The following notes are taken from the authors' summary :—Oxidase and catalase activity were not directly correlated with rate of respiration or with one another in fruits submitted to various storage temperatures and to various chemical respiratory stimulants or depressants. There was a positive correlation between rate of respiration and oxidase and catalase activity in growing Bartlett pears from an early stage until commercial harvest maturity. Catalase activity was positively correlated with rate of respiration in Bartlett pears as long as they were on the tree. Interrelation of respiration, catalase and oxidase failed to hold after removal of the fruit from the tree to storage, whether the fruit was allowed to reach full harvest maturity or not.

1274. HORNE, A. S., AND TOMKINS, R. G. 664.85.11 : 632.4
The relation between resistance, mortality and spore load of apples coming from the Fen country, Kent and West of England.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 136-41, bibl. 4.

The relation between resistance, mortality and spore load of apples coming from the fen country, Kent and West of England and submitted to similar storage treatments is here considered.

1275. HORNE, A. S. 664.85.11 : 632.4
The resistance of the apple to fungal invasion.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 147-61, bibl. 4.

Resistance influenced by locality. Apples from Kent and from Ulster again formed the experimental material. As touching penetration via lenticels the average for Kent was 72.7 as compared with 26.5 for Ulster in the case of *Penicillium* and in that of *Botrytis* the Kent average was 28.5 as compared with the Ulster 4.0. Penetration via punctures was faster and much more universal in apples from Kent. Measurements of radial advance of infection showed that resistance in Kent apples was less initially and fell more rapidly with passage of time than in Ulster apples. Again natural spotting was very much greater in Kent. As regards the effect of manures, whereas treatment with potash induced resistance to fungal invasion in Grenadier, so agreeing with last year's results, it either proved ineffective or actually induced susceptibility in Worcester Pearmain. Work on the effect of stock and manurial treatment indicates that, when stocks were considered individually, mean values of radial advance and those of mean nitrogen content ran nearly parallel, both increasing with treatments arranged thus : K, C, NK, N. In agreement with previous results treatment with K or NK raised the acid content of the fruit and treatment with N had no effect. Results on fungal infection of injecting comparable Bramley's Seedling trees with sodium phosphate, urea, sodium phosphate and urea, glucose and urea, and fructose and urea are also recorded and discussed. The response to such treatment would appear to depend somewhat on the occasion when the trees are injected. Thus fruit from trees injected in July with urea was highly susceptible compared with that from trees receiving sodium phosphate, but fruit from trees similarly treated in August was not correspondingly susceptible and one set was more resistant.

1276. EZELL, B. D., AND GERHARDT, F. 634.13-1.547.6 : 664.85.13
Oxidase and catalase activity of Bartlett pears in relation to maturity and storage.

J. agric. Res., 1938, 56 : 337-46, bibl. 15.

Oxidase and catalase determinations in Bartlett pears were made at different stages of maturity and the effect of maturity and of storing at 32° on enzyme activity were determined. Oxidase activity decreased throughout the growing season. The catalase activity formed a U-shaped curve from the time the pears were very small until they were tree ripe, the minimum being reached about the time of harvesting for canning. High oxidase activity is correlated with practices which give a poor colour to canned pears and low activity with practices giving a good colour. Catalase activity is apparently unrelated to colour development in canned Bartletts but may be related indirectly to quality, since the best results are got with fruit picked at or just after the lowest point in the catalase curve.

1277. CULPEPPER, C. W., LUTZ, J. M., AND MOON, H. H. 634.13 : 664.85.13
Handling and preparing the Kieffer pear for use as food.
Fmrs' Bull. U.S. Dep. Agric. 1796, 1938, pp. 15.

Special methods of preparation in cooking, canning and preserving the somewhat despised Kieffer pear are described here. The time necessary for ripening to take place varies with the stage of maturity of the fruit when harvested. After harvest the fruit may be stored at 32° F. for a limited period of 2-4 months during which time little apparent change takes place. However, if the pears are placed in a ripening room at 60° F. after storage at 32° F. they require a shorter time to ripen than they would if ripened at 60° F. immediately after harvest. Although the stone cells are not destroyed during ripening, they do become much less objectionable. In the preparation for canning, preserving or drying, it is recommended that the fruit should be sufficiently cored to remove the more conspicuous clusters of stone cells located near the core.

1278. FURLONG, C. R. 664.85.22
The effect of different temperatures for conditioning imported plums.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, p. 170, bibl. 3.

A temperature of 64° F. was found the optimum temperature both for complete ripening or conditioning Santa Rosa and Gaviota plums.

1279. DAVIES, R., AND BOYES, W. W. 664.85.22.037
Cold storage of plums.
Rep. Low Temp. Res. Lab., Capetown, for the year June 1935-June 1936, 1937, pp. 69-129.

Trials with a large number of Japanese plums suggest that one group can be best shipped at or a little above 45° F. and the other at 31° F. or $\pm 45^\circ$ F. and that the maturity at picking probably needs adjustment according to the temperature at which the plums are to be kept. Hints are given of the stages of maturity which are probably suitable for each temperature respectively.

1280. FURLONG, C. R. 664.85.13 + 664.85.22
The ripening of imported pears and plums.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 168-70, bibl. 6.

The author has continued his investigations on the various factors which affect ripening of fruit received after prolonged storage. In this article he considers the effect of box and time of unpacking on pear ripening, treatment of pears and plums with ethylene [ethylene was not effective in ripening Williams and Beurré Bosc pears or Gaviota plums], and forms of over-ripeness.

1281. DAVIES, R., BOYES, W. W., AND DE VILLIERS, D. J. R. 664.85.25.037
Cold storage of peaches.
Rep. Low Temp. Res. Lab., Capetown, for the year June 1935 to June 1936, 1937,
 pp. 130-60, bibl. 13.

Storage temperatures below 45° F. would appear to set up abnormalities in the peach just as in Japanese plums and that these increase between 45° and 37° F. Between 37° F. and 31° or even 29° F. they are delayed. Low temperature storage for peaches is therefore only possible for limited periods, but the lower the temperature, the longer the period of storage. These conclusions agree with those reached by other workers.

1282. SMITH, W. H. 664.85.75.035.1
The cooling and storage of strawberries.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 162-5.
The gas storage of strawberries.
Ibidem, pp. 165-6.

Great difference was observed in the inherent storage qualities of strawberries in 1936 and 1937, the 1937 strawberries having 2 or 3 times as long a storage life as the 1936. Storage at low temperatures, i.e. 32° F., did not detract from the appearance of the fruit. The wastage in fruit stored at this temperature for 10 days did not increase, whereas the waste in fruit held at 65° F. increased rapidly. On the other hand cold stored fruit tended to waste more quickly at 65° F. than fruit not cold stored. The rate of cooling had apparently little effect. Gas storage clearly retarded wastage and an atmosphere of 10% CO₂+10% O₂ at 32° F. was an improvement on air at the same temperature. Trials are being continued.

1283. RATTRAY, J. M. 664.85.872
Grape wastage investigations.
Rep. Low Temp. Res. Lab., Capetown, for the year June 1935 to June 1936,
 1937, pp. 167-87.

In summarizing his results the author makes certain recommendations and statements including the following:—Grapes brought in with dew on them should be packed at once. Botrytis develop freely at 34° F. given favourable humidity. If botrytis is going to occur after rain it will do so within 3 days and the indications of its presence should then suffice to delay picking. Wrappers with low porosity and maintaining high humidity conditions in the bunch result in the freshest condition of grapes after storing. Obviously, however, in a season likely to favour botrytis development such wrappers would be dangerous. Crêpe-paper plugs treated with a .50 N solution of iodine inserted in bunches wrapped in a wrapper of low porosity, e.g. one made of "crystalline" paper, largely reduce wastage. The less pre-storage the better the results of storage. Wastage always develops in bunches from which infected berries have been removed, hence infected bunches should be discarded. Spraying the woodwool lining with 4% formalin had little effect. Dusting the bunches with Brassisan before picking or just before packing is not entirely satisfactory. Woodwool did not affect the flavour of Gros Colman and Whitepoet grapes. The fact of irrigation would not appear to affect the keeping quality of grapes in storage, though in one case, i.e. that of the Alphonse Lavalle variety, the non-irrigated were greatly superior to the irrigated consignment.

1284. BEYERS, E. 664.85.872
"Drop berry" in Waltham Cross grapes.
Rep. Low Temp. Res. Sta. Lab., Capetown, for the year June 1935 to June 1936,
 1937, pp. 187-99.

The conclusion is reached that the main factors determining drop in Waltham Cross grapes at Paarl are atmospheric conditions and soil moisture in the month before picking. Moreover, picking in the morning appeared to be preferable to afternoon picking and delaying storage for more than 24 hours was not only detrimental to quality but increased the tendency to drop.

1285. BARKER, J. 664.85.872
The storage of hot-house grapes.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 166-7, bibl. 1.

Previous methods with the water feeding method (*Ibidem for 1936*, p. 152, *H.A.* 7 : 1057) were confirmed and muscat grapes thus stored for 7 weeks at 34° F. were in good condition both after storage and after 14 days at ordinary temperature. As before grapes cut when nearly fully mature did not keep so well as less mature grapes. The Colmar had a shorter satisfactory storage life, namely about 4-6 weeks. Water feeding was found to be feasible with considerable saving in space by means of a small rubber bulb fitted to the stalk, the bunches with these bulbs attached being packed in boxes in the usual commercial manner. In both varieties results with water feeding were incomparably better than without.

1286. KIDD, F., AND WEST, C. 664.85.11.035.1
Gas storage of apples : precautionary measures.

J. Minist. Agric. Lond., 1938, 45 : 691-9, bibl. 16.

Certain precautions, which are especially liable to be overlooked in practice, are dealt with in this article. *Correct temperature and atmosphere.* Most gas stores in this country have been designed primarily for Bramley's Seedling, but many dessert varieties such as Cox and others need an atmosphere in which the concentration of both O₂ and CO₂ is low. Such atmospheres cannot be obtained merely by regulating the ventilation. Standard equipment to achieve the desired atmosphere including suitable instruments for measuring both O₂ and CO₂ is now available. *Stage of maturity at picking.* The most reliable index of proper time for picking still remains the facility of the fruit to part readily from the tree when gently twisted. Obviously with large crops some of the fruit will be picked before and some after this stage. That picked after should be marketed at once and will not stand storage, that picked before may stand gas or cold storage for a relatively short time. *Interval between picking and storing.* This should never exceed 3 days. *Mixing varieties in a store.* Even when different varieties require similar atmospheric conditions in the store this does not mean they can be stored together. Apart from picking dates and storage periods in each case the varieties are likely to affect one another by the volatile substances produced during ripening. This may result in lenticel spotting, scald, etc. *The initial effect of CO₂ on the respiratory activity of apples.* There is sometimes a more rapid increase of CO₂ in commercial gas stores in the first few days after closing than is expected. Recent work indicates that apples in the pre-climacteric condition show, on exposure to atmospheres containing up to 10% CO₂, a temporary increase in respiratory rate. Hence immediately at the outset there is a chance, especially if the fruit is warm and therefore respiring freely, of dangerous concentrations of CO₂ being reached. Its concentration during this period must therefore be watched closely.

1287. KIDD, F., AND WEST, C. 664.85.11.035.1
The action of carbon dioxide on the respiratory activity of apples.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 101-2, bibl. 1.

Results of laboratory work indicate that in the preclimacteric phase of apples stored in artificial atmospheres an immediate but transitory effect of CO₂ is to increase respiratory activity. The more immature the fruit up to a point, the greater is the effect.

1288. KIDD, F., AND WEST, C. 664.85.11 : 581.192
The uptake of oxygen by apples.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 102-8, bibl. 2.

The authors deal with 2 series of experiments. In the first mature Bramley Seedling apples (av. wt. 168.5 g.) were stored at 72° F. In this the uptake of oxygen followed the same trend as the production of CO₂. The ratio of CO₂/O₂ by volume rose from about 1.02 during the preclimacteric period immediately after gathering to about 1.25 on the peak of the climacteric and thereafter more slowly to 1.4 in 24 days. The work continues. In the second series of experiments immature Bramley Seedling apples (av. wt. 29 g.) were stored at 50° F. and 37.4° F.

Results with these apples at 50° F. show that the uptake of O₂ meets requirements for oxidation of acid and carbohydrate lost and that loss of carbohydrate but not loss of acid occurs at the climacteric. The low value of the CO₂/O₂ ratio observed just after picking appears to be associated with an initial phase corresponding to the time during which starch is disappearing and in which acid is lost. The low value of the ratio suggests that there may be acid formation during this phase.

1289. KIDD, F., AND WEST, C. 664.85.13.035.1

The gas storage of English-grown Williams Bon Chrétien Pears.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 93-7, bibl. 1.

Trials reported in a previous year (*Ibidem for 1936*, p. 113, *H.A.*, 7 : 1055) were repeated, and the relative effect of different storage variables was brought out clearly by the results. The fruit was gathered from the same trees and on the same date as before. The pears had an average weight of 133 g. a hardness value of 23.5 lb. as measured in a penetrometer (dimension of plunger diameter of slightly convex head 8 mm., depth of penetration 8.2 mm.) and contained only a moderate amount of starch. Temperatures used for ripening were 50° F., 60° F. and 70° F. 60° proved best and 50° F. worst. The best storage results were got at the lowest storage temperature 31.5° F., and at most of the atmospheres at this temperature results were better than in air. Of the atmospheres tested 2.5% O₂+10% CO₂ was the best. The storage life in gas-store was this year 5-6 months as against 6-7 months in 1935-6 and rather less than 2 months in ordinary cold store. In contrast to the previous season a little brown heart developed late in the atmospheres containing 10% CO₂ but only at the two higher temperatures namely 60° and 70°.

1290. GERHARDT, F., AND EZELL, B. D. 664.85.13.035.1

Effect of carbon dioxide storage on Bartlett pears under simulated transit conditions.

J. agric. Res., 1938, 56 : 121-36, bibl. 26.

The potential storage life of Bartlett pears held at 45° F. for 20 days in 20% CO₂ or for 30 days in 35% CO₂ did not differ significantly from that of fruit stored at 32° F. in air. It was found possible subsequently to store at 32° F. and ripen at 65° without loss of dessert quality fruit previously treated in this manner. The recommendation is made that when Bartlett pears are to be held in transit or store at temperatures appreciably higher than 32° and it is necessary to curtail the ripening processes, CO₂ at a concentration of approximately 20% should be added to the storage air. CO₂ was found to reduce surface scald. Soluble pectin content increased more than thirty fold during ripening and then decreased with progressive senescence. CO₂ retarded ripening by curtailing the processes associated with hydrolysis of protopectin. The soluble pectin content of fruit stored at 45° F. in 35% CO₂ was comparable with that of fruit stored at once in air at 32° F. It is suggested that a determination of soluble pectin in Bartlett pears might prove to be a valuable index of the degree of ripeness or of the potential storage life of the fruit at any given time. [From authors' summary.]

1291. ISAAC, W. E. 664.85.22.035.1

Gas storage of Kelsey plums.

Rep. Low Temp. Res. Lab., Capetown, for the year June 1935 to June 1936, 1937, pp. 160-7, bibl. 5.

Gas storage of Kelsey plums was not a success and severe browning occurred as a result. The conclusions appear justified that the storage of such plums in atmospheres containing 5 to 15% CO₂ does not lead to beneficial results and that concentrations of 10 and 15% CO₂ are definitely injurious.

1292. HANES, C. S. 581.192 : 581.12

Studies of the action of amylases.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 115-7, bibl. 3.

1292. HULME, A. C. 634.11 : 581.192 : 664.85.11
The metabolism of nitrogen in apple fruits. Alcohol soluble fractions.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 117-21.
 HULME, A. C., AND MCKEE, H. S. 634.11 : 581.192 : 664.85.11
Amino-acids and amide of the apple fruit.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 121-3, bibl. 4.
 HULME, A. C. 634.11 : 581.192 : 664.85.11
The wax content of apple fruits.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 123-4.
 FIDLER, J. C. 581.192 : 581.12
The role of acetaldehyde in the catabolism of carbohydrate.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 124-6, bibl. 2.

1293. / KOKONOV, M. 664.85.3
Prolonged storage of citrus fruits. [Russian, English summary 12 lines.]
Soviet Subtropics, 1938, No. 8-9 (48-9), pp. 39-40.

Special methods for reducing the rate of deterioration of citrus fruits stored for 3, 5 and 8 months are recommended. The method which was tested in 1936-7 on a commercial scale consists essentially in packing the fruits in standard boxes, covering them with peat and storing the boxes in well-aerated rooms having an air humidity of 85-95% and at temperatures ranging between +5 and +7° C. The fruit-stalks should be either left rather long when the fruit is harvested and be cut only after they had wilted, or else the cut surface should be treated with a particular fungicide (identity not stated—ED.) when harvesting.

1294. FIDLER, J. C. 664.85.31.035.1 : 581.192
The loss of acid from oranges stored in air and in nitrogen.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, p. 126.

Experiments have shown that the rate of loss of acid from apples is the same both in nitrogen and in air. It is now further shown that the presence or absence of oxygen is similarly without effect on loss of acidity in oranges.

1295. TOMKINS, R. G. 664.85.31.035.1
The effect of ventilation on the wastage of oranges in storage.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 141-7, bibl. 7.

The author used sound oranges and specially wounded oranges in his ventilation experiments. He outlines the conclusions drawn from results with wounded oranges. As regards sound oranges, however, the total wastage is often low and shows great variation. It was found with sound oranges that storage in dry as compared with saturated air results in some reduction in wastage, that restriction of ventilation allowing up to 5% CO₂ to accumulate did not appreciably increase wastage as compared with that in saturated air. If then, as is supposed, lack of ventilation does increase wastage, this must be due to the conditions of high humidity arising from restricted ventilation. Also the difference in the extent of wastage of fruit on the inside and the outside of a box is determined by the difference in evaporation, which is much greater in the outer fruit. In these experiments, however, oranges were removed as soon as they were seen to rot. Hence the effect of ventilation described refers only to the initiation of rotting.

1296. \ BROOKS, C., AND McCULLOCH, L. P. 664.85.334 : 632.19
Some effects of storage conditions on certain diseases of lemons.
J. agric. Res., 1937, 55 : 795-809, bibl. 5.

The lemons used in the experiments were sent under ventilation in car lot shipments from Los Angeles to New York, whence they went by ordinary express to Washington, D.C. The experiments were begun at the Arlington Experiment Farm within a day of their arrival at Washington.

In some experiments 20-30 lemons of a particular maturity were used under each storage condition, while in other later experiments 50 to 60 lemons formed the test unit. The waxes used were made by mixing paraffin and mineral oil in about equal proportions, beeswax being sometimes substituted for part of the paraffin—apparently without effect. The following notes are taken from the author's summary: Fruit was held at 32°, 36°, 40°, 50° and 60° F. For the first 2 months there was more decay at the higher temperatures, but later this was reversed, apparently owing to decay following watery breakdown and pitting. CO₂ did not check alternaria decay. Pitting was the great limiting factor at the lower temperatures, though holding the lemons at 32°, 36° or 40° for 1 or 2 weeks before storing at a higher temperature did not increase pitting. Pre-storage in atmospheres of high CO₂ content tended to decrease pitting. Waxed fruit developed less pitting than unwaxed. Membranous stain increased with the temperature used from 1% incidence at 32° up to 75-100% incidence at 40° F. It was also increased by the use of CO₂. Its incidence was less in waxed than in unwaxed fruit. Watery breakdown occurred at 32° F. but not at higher temperatures. Scald and red blotch were sometimes found on fruit stored at low temperatures. Pre-storage use of high percentages of CO₂ tended to delay colour development. Waxed fruit lost weight and firmness very much more slowly than unwaxed.

1297. HOLMES, N. E., FIDLER, J. C., AND FURLONG, C. R. 664.85.31
The effect of position in the box on the incidence of a physiological injury of the skin in oranges.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, p. 171, bibl. 4.

Considerably more physiological injury was found in the skins of orange in inside positions in the packing box than in those of oranges in the outside positions.

1298. TROUT, S. A., TINDALE, G. B., AND HUELIN, F. E. 664.85.31 : 581.02
The storage of oranges with special reference to locality, maturity, respiration and chemical composition.

Pamphl. Coun. sci. ind. Res. Aust. 80, 1938, pp. 59, bibl. 23.

The investigations here described were carried out by the co-operation of the Department of Agriculture of Victoria and the Council for Scientific and Industrial Research prior to 1935, and an abridged account was submitted to the Imperial Botanical Congress in 1935. The latter, however, decided against publishing Proceedings of the Congress, and in view of the value of the data accumulated they are published here for the first time. The results of tests and observations are given in considerable detail with numerous explanatory graphs and tables. The importance of such factors as variety, locality, and time of picking on storage life is clearly shown. The following notes are taken from the authors' summary:—Subjecting Washington Navel oranges to sweating (high temperature treatment) did not effectively control mould development. There were, however, indications that it did make the fruit less susceptible to mechanical injury and to subsequent low temperature disorders. Washington Navels picked from Merbein in early June remained palatable for 12 weeks at 40°-42° F. and for a further week at atmospheric temperatures. If the fruit was left on the tree for a further period life in cool store was reduced by an equivalent period. Washington Navels from the later maturing districts had the same cool storage life as those from the earlier maturing districts on the same date. The rate of progress towards senescence is the same in all districts, but in the later maturity districts the fruit takes longer on the tree to become palatable. Storage life in cool store terminated about 1 month after maximum respiratory activity. Whereas progress towards senescence was about the same whether the fruit was picked or not, the development of colour and flavour and the loss of acidity were retarded by picking and storage at 40°-42° F. On the tree sugar continued to increase in the rind, whereas it was actually lost from the rind during storage. Although palatability depended on juice composition, respiration and storage life appeared to be more related to the constituents of the rind. The titratable acidity of the juice

is preferred to the Brix/acid ratio as an index of maturity. Storage temperatures of 40°-43° F. gave the best results with Valencia Late oranges from two sources picked in mid-December and under such conditions loss of palatability occurred at the end of 14 weeks.

1299. **WARDLAW, C. W.** 664.85
The storage of tropical fruits.
Trop. Agriculture, Trin., 1938, 15 : 171-3.

This paper was contributed to Section 10, Storage of fruit and vegetables, of the International Horticultural Congress at Berlin, 1938. The paper deals briefly with the more general results of the author's work under the following heads: (1) Horticultural relationships, that is—environmental factors, selection of suitable varieties, standardization and conservation of desirable types. (2) Harvesting maturity, which is specific to each fruit and sometimes varies for a given fruit with the country of origin. (3) Pre-storage treatment, and the necessity for quick handling between field and store, except in the case of citrus fruits in a highly turgid condition, when a preliminary period of quailing (curing) is necessary; care must be taken in the application of disinfectants which in certain circumstances, such as latent infections, may only increase the damage. (4) Cold storage, where the temperature must be low enough to control ripening but not so low as to cause chilling, the chilling point differing with each variety, and the maintenance of a proper humidity. (5) Post-storage and ripening, and the necessity for providing some kind of refrigeration on arrival at destination to slow down the rapid ripening that will otherwise take place on removal from the ships' refrigerators to air temperature. (6) Wastage, due to wound parasites or dormant infections which do not become evident till a certain stage of senescence has been reached.

1300. **MYAZDRIKOVA, M. N.** 664.84.34 + 664.84.13
Vegetable storage. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 8-9, pp. 16-8.

This is a brief tabulated report of storage trials with carrots and cabbage in U.S.S.R. Among the conclusions reached were the following: The most serious disease of cabbage was *Botrytis*, while most losses of carrots were mainly due to white rot. A fine commercial mixture of carrots proved much less hardy in storage than pure varieties of carrots.

1301. **LERMONTOV, M. A.** 664.84.25
The storage of onions at low temperatures. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 8-9, pp. 26-7.
PALILOV, N. A. 664.84.25
Onion yields as dependent on the storage of seed-onions. [Russian.]
Ibidem, pp. 23-6.

In both articles the behaviour of onions in storage at varying temperatures is described, results being tabulated.

1302. **SHMANEV, M. H.** 664.84.13
Storing carrots after treating them with lime. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 8-9, pp. 28-30.

Black and white rot of carrots in storage was substantially reduced when they were treated with milk of lime (25 kg. quick lime per 100 l. water). Temperatures and other storage conditions are noted and tables show the results obtained in trials in the 1934-5 season and in 1935-6.

1303. **NESTEROVA, V. C.** 664.84.64
Early maturity and storage of tomatoes. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 8-9, pp. 18-21.

In 1936-7 methods of hastening the ripening of stored tomatoes were studied at the Institute of Vegetable Production. Different lots of tomatoes were exposed to ethylene, injected with ethyl alcohol by means of a syringe, covered with either peat or sawdust, or not subjected to

any treatment. The results, which are given in tabular form, may be summed up as follows :— Tomatoes treated with pure ethylene ripened on the 12th day (98·7%) while the control fruit ripened only on the 23rd day (98·2%). The loss of tomatoes due to disease was higher in the controls, viz. 1·8% as compared to 1·3% of ethylene treated tomatoes. Similarly good results were obtained from covering tomatoes with peat and sawdust. Ethyl alcohol injections were much less effective, but fair results could be obtained under laboratory conditions. In another set of experiments storage hardness of certain tomato varieties was determined during the slow ripening process of green fruit. The results are discussed in some detail. The conclusion was reached that slow ripening of green fruit of hardy varieties can be secured by storage temperatures ranging between 10° C.-15° C. with air humidity between 65-75%. In order to avoid heavy losses, however, fruits of badly keeping varieties must be stored at 20° C.-30° C.

1304. SMITH, W. H. 664.84.356
The storage of broccoli.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 185-7.

So far as experiments have shown storage in air is preferable to storage in artificial atmospheres. The best air temperature in these experiments was 32° F. ; broccoli stored well for 14 days at this temperature and kept well for another 5-6 days at 50-65° F.

1305. BARKER, J. 664.84.21
Changes of sugar content and respiration in potatoes stored at different temperatures.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 175-7, bibl. 2.
The sugar content of potatoes.
Ibidem, pp. 178-9, bibl. 2.
 KIDD, F.
The internal atmosphere of potatoes.
Ibidem, pp. 179-84.
 ISHERWOOD, F. A.
Reducing substances present in potatoes.
Ibidem, pp. 184-5, bibl. 4.

The authors in the above articles deal with various problems encountered in the storage of potatoes.

1306. BARKER, J., AND GANE, R. 664.84.656.037
Rates of cooling of peas frozen by different methods.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 195-7.

The rate of cooling peas in tins was greatly accelerated by using brine rather than still air as a freezing medium. The effect of cooling in different types and shapes of container was also tested. Finally, since the preference for large packages increases the difficulty of getting rapid rates of freezing under commercial conditions the possibility of freezing prior to packing was explored. The quality of peas frozen in a single layer in still air at -4° F. and in sodium chloride brine at -4° F. was excellent and it is thought that such methods may prove suitable for commercial use.

1307. BARKER, J., AND MORRIS, T. N. 664.84.656.037+664.84.31.037
Analytical studies of frozen vegetables.
Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 190-4, bibl. 5.

The authors conclude that freezing affected the permeability of the vegetables tested, namely, asparagus and peas, so that solutes leached into the cooking liquor more readily than from the fresh unfrozen vegetables. In general, samples of peas frozen quickly resembled fresh cooked peas more closely as regards loss of solutes, extent of wrinkling and residual sugar content than

did samples frozen more slowly. The influence of rate of freezing on colour and flavour of peas is not entirely clear yet. With asparagus slow freezing resulted in poor colour and flavour after cooking. It was found that the loss of sugar incurred in cooking fresh peas was 40% and that in cooking frozen peas an additional 5-20%.

1308. MORRIS, T. N., AND BARKER, J. 664.84.656.037

The preservation of peas by freezing.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 187-9.

Points still under investigation include the following :—(1) *Effect of stage of ripeness and of variety.* There are great differences between varieties in capacity for standing up to freezing and the best results are obtained in all cases from young tender peas. (2) Duration and temperature of scalding. (3) Methods of freezing and storing. (4) Use of sodium carbonate in the scalding water [this should be dispensed with where possible]. (5) Use of a covering liquid [immaterial provided peas are protected from evaporation during storage]. (6) Containers.

1309. APP, F. 664.84.037

Quick freezing, the fourth milestone in vegetable distribution.

Trans. Peninsula hort. Soc. 1937, being Bull. St. Bd. Agric., Dover, Delaware, 1938, Vol. 27, No. 5, pp. 70-4.

The author notes the following stages in distribution of vegetables :—(1) Preservation by canning said to have been invented in 1795 by a Frenchman, Nicholas Appert ; (2) refrigerated transport ; (3) mass distribution by chain stores ; and (4) quick freezing. The advantages of the last are the possibility of holding throughout the year without deterioration. He notes that most vegetables do not reach the consumer till at least 24 hours after picking when their sugar content has greatly diminished. Quick freezing preserves the sugar content, tenderness and general appearance. When properly blanched, frozen and stored at low temperatures, the garden fresh colour is retained for most vegetables that are normally cooked. So far, however, satisfactory methods of quick freezing cabbage, tomatoes, cucumbers, celery, radishes and lettuce and other vegetables of a crisp texture have not been devised. Submitted to ordinary quick freezing they become flabby and unattractive.

PACKING, PROCESSING, PLANT PRODUCTS.

1310. GARNETT, F. E. (MINIST. AGRIC., LOND.). 664.85.11.035.1 + 634.11-1.564

Planning the erection of apple packing houses and storage buildings.

Notes for national mark apple packers, 16, May 1938, pp. 12.

In this article detailed, practical recommendations are made on the planning of gas-stores and pack-houses for apples to secure a maximum efficiency in the primary operation of marketing. The management of packing houses and storage buildings is not discussed here, but a further note on the subject is promised.

1311. MATHIEU, G. 664.85.87

Sur la conservation du raisin de table en Provence. (Table grape preservation in Provence.)

C.R. Acad. Agric. Fr., 1938, 24 : 307-11.

A comparison is made of the two methods commonly adopted in Provence for storing table grapes, namely packing in powdered cork at an air temperature of +2° C. and a humidity of 80 and laying on hurdles at ordinary room temperature. The latter method is generally only used in the home and is found to result in a much quicker loss of quality, as shown by loss of weight, i.e. 32-36% as compared with a loss of 0-4% in cold stored grapes at the end of 75 days. The

recommendation is made that only specially selected late varieties such as Servan tardif or Olivette should be stored; that they should be picked at a normal state of maturity in which the sugar : acid ratio is about 30; and that they should be stored in cold chambers at +2° C. and at a humidity of 80.

1312. NEW SOUTH WALES DEPARTMENT OF AGRICULTURE. 664.85.22.047
When drying prunes.

Agric. Gaz. N.S.W., 1938, 49 : 95-7, 107.

Results of experiments carried out at the Wagga and Cowra experiment farms supported the recommendation of the Department of Agriculture that trays of freshly dipped prunes should be stacked for a few days until initial shrinkage had taken place before being spread out for drying. This stacking in no way delayed drying and was the means of avoiding case-hardening, a trouble which adversely affects the quality of the dried product and causes difficulties in processing.

1313. D.S.I.R.* LONDON. 664.8.036.5
Report of the Director of Food Investigation for the year 1937. Section VII
—Canning.

Rep. Fd Invest. Bd, Lond., for 1937, 1938, pp. 199-209.

This section of the report deals with work on the following subjects: corrosion of tin, corrosion of aluminium, storage of strawberries for canning, the effect of sulphurous acid on the setting power of the pectin of heated fruit pulps, and the utilization of the peel in the canning of apples.

1314. KROKER, F. 577.16 : 664.84 + 664.85
 Der Einfluss des Kochens, der Hitze-Konservierung und der Trocknung auf den Vitamingehalt von Obst und Gemüse. (**Cooking, drying and preservation by heat as affecting vitamin content in fruits and vegetables.**)
Forschungsdienst, 1938, 6 : 107-29, bibl. 121.

The storage capacity of vegetables and fruit is considerably improved by drying and preserving by heat. Biological properties do not undergo or undergo only slight changes, except for the loss in vitamin content. *Vitamin A* and its pro-vitamin stages are relatively little affected by heat and are reduced only to a small extent during ordinary cooking and preservation processes. Drying, however, is a different matter. Here, especially after sun-drying, great losses occur. Sulphuring fruit helps to preserve vitamin A. *Vitamin D* is very little affected, but in any case its occurrence in fruit and vegetables is very small. *Vitamin E* content is practically unaffected. Water-soluble *Vitamin B*, however, is more easily affected than the above fat-soluble vitamins. It is noticeably inactivated only at temperatures above 100° C., but is rapidly destroyed at temperatures above 120° C. In boiling a great part of this vitamin is transferred to the water and is lost, if this water is poured out. In dried fruit less vitamin B is lost from sulphured fruit than from other fruit. Vitamin B₂ [G] is still less affected by heat, so that nearly all losses occurring during cooking and preservation are due to extraction by water. *Vitamin C* is extremely easily oxidized. It is water-soluble and is easily extracted in boiling water. Utilization of this water in cooking is, therefore, very important. This vitamin is fairly constant under acid conditions, and smaller losses therefore occur in acid vegetables and fruits than in others. The relationship surface/volume of vegetables and fruit has also some influence on the degree of vitamin C losses. The influence of various methods of preservation on vitamin C content has not yet been sufficiently studied, but methods in which the amounts of oxygen present are reduced to a minimum are considered best, provided that a higher cost of production is justified. Mere traces of certain metals, above all copper, have an extremely favourable effect on vitamin C content. In determining vitamin C content titration results should be checked by biological

* Department of Scientific and Industrial Research.

tests. Almost complete destruction of vitamin C results from drying and only in the case of lemon juice have good results been achieved by one or two workers. The large list of references should be noted.

1315. IVANOV, N. N. (Editor). 577.16 : 634/5

Problems of vitamins. [Russian, English summaries 13 pp.]

Supplement to Bull. appl. Bot., Leningr., **84**, 1937, pp. 338, bibl. 409.

This is the second part of a symposium of experiments carried out at the Vitamin Laboratory of the U.S.S.R. Institute of Plant Industry and edited by N. N. Ivanov.* The object of the studies is to aid plant breeders in the selection of plants that not only produce larger amounts of vitamins in their fruits, but also whose fruits retain the vitamins better during storage and processing. As a result advance has been made in the field of vitamin dynamics in certain plants and plant products, and light has been thrown on certain reasons for the variation in vitamin content of different plant products. The work discussed in the present volume includes the following investigations: the rôle of light in the formation of vitamin C in peas; anti-scorbutic properties of various fruit berries, needles of *Pinus pumila*, lichen, peppers, tomatoes, cultivated apple varieties, wild apples, pears and plums, grapes, various fruits and vegetables of the North Caucasus, green walnuts, dog rose, carrots; the stability of ascorbic acid.

1316. HIRST, F., AND ADAM, W. B. 664.85.22.036.5+634.22-2.19

Fruit gumming of Victoria plums. (Preliminary report.)

Annu. Rep. Fruit Veg. Pres. Sta., Campden, for 1936-1937, 1938, pp. 17-23, bibl. 1.

Gumming of plum fruits is a serious objection to canned plums and the aim of these investigations is to discover a method of preventing this phenomenon. As Victoria fruit is known to be particularly prone to gumming and is the highest grade of plum normally canned, it was decided to limit the preliminary investigation to this variety. Two factors relating to growth were studied this year, namely rootstock and age of tree, and the fruit was obtained from trees of known history in the Long Ashton and East Malling Research Station orchards. The work is being continued but certain tentative conclusions, which need confirmation by further work, are reached: 1. Gumming appears to be a varietal characteristic and is influenced by seasonal conditions. 2. Most of the gumming is probably due to physiological causes, but some is due to external injury or insect damage. 3. Rootstock and age of tree appear to have little effect on its incidence. 4. Although grading by removal of fruit showing external gum does not grade for internal gum, it is possible that grading according to the position of the external gum may give a better separation.

1317. JOACHIM, A. W. R. 664.8.036.62+663.815

The canning and bottling of local fruit and the preservation of fruit juices and cordials.

Trop. Agriculturist, 1938, **90** : 261-73.

The results of 5 years' work of the Chemical Division of the Department of Agriculture of Ceylon in the experimental canning and bottling of local fruits and fruit juices is discussed. There are appendices from various research stations and importing firms abroad, containing reports on samples, on the domestic canning of fruit and the preparation of fruit juice squashes. The reports consider the products excellent for local sales or sales in adjacent countries but that they would probably not interest the European markets. It was found that many local varieties were not suitable for canning, pineapples and certain mangoes for instance, and steps are being taken to introduce suitable kinds. The cost of the can is, however, prohibitive at present and bottling is more likely to be commercially successful as bottles can be used again. Fruit juices and cordials have been prepared very successfully, though they have to be chemically preserved. They command a ready local sale.

* Ivanov, N. N. Problems of vitamins. *Supplement to Bull. appl. Bot. Leningr.*, **67**, 1934.

1318. GILLESPIE, T. G. 632.42 : 664.85.036.5
Studies on the mould *Byssoschlamys fulva*. (Progress report.)
Annu. Rep. Fruit Veg. Pres. Sta., Campden, for 1936-1937, 1938, pp. 68-75,
 bibl. 75.

The work described here is of a preliminary nature and includes both field and laboratory investigations on the incidence of the heat-resistant mould, *Byssoschlamys fulva*, which is responsible for disintegration of canned fruits.

1319. LAL SINGH AND GIRDHARI LAL. 663.815
Studies in the preservation of fruit juices. I. Some observations on the preparation and preservation of citrus fruit squashes.
Indian J. agric. Sci., 1938, 8 : 77-102, bibl. 20.

The following information has been obtained from the experimental preparation of citrus squashes (Malta orange and local and imported lemons), the work being part of the research scheme on fruit preservation in the Punjab, fostered by the Imperial Council for Agricultural Research. Various methods were tried and different sugar concentrations, 35°, 45° and 65° boiling strength. Storage was at room temperature for 1½ years. Citrus fruit squashes with a high sugar content, 65° B, retain their fresh fruit stability and character to a marked degree. The flavour is considerably improved by the addition of well ground and strained peel emulsion of 2-4% fruits used for juice extraction, particularly in the case of squashes with high sugar density, whereas with low sugar content a slightly bitter, though palatable, taste is given. Preservation with sulphur dioxide gives a superior flavour to that imparted by sodium benzoate or pasteurization. Sodium benzoate, even at its purest, gives a peculiar chemical odour resembling iodoform and a burning taste whereas pasteurized squash has an unpleasant, cooked flavour. Sulphur dioxide imparts a slight sulphurous odour to the freshly prepared product which is not noticeable in the diluted beverage and disappears entirely after 9 months storage at room temperature. A suitable concentration of sulphur dioxide, well below the permitted amount, is 100-200 p.p.m. in squashes of high sugar content and this is most conveniently added in the form of potassium meta-bisulphide. Pasteurized squash spoils in a few days after opening, chemically preserved squash will keep for some time. Squash preserved otherwise than with sulphur dioxide undergoes marked colour changes after about 1½ years storage. Rate of sediment settling is much slower in pasteurized squash than in chemically preserved squash, cloudiness still persisting in the former after a year's storage. Recipes and costs of production are included in the article.

1320. ADAM, W. B. 664.85 : 581.192
The acidity and hydrogen ion concentration of English canned fruits.
Annu. Rep. Fruit Veg. Pres. Sta., Campden, for 1935-1936, 1937, pp. 51-61,
 bibl. 4.

Some 400 determinations were made in the previous three years on the question of variability of pH and acidity in English canned fruit. Comparisons were made between fruit from early, middle and late blossoms in the case of loganberries and blackberries and such effects as those induced in pH by the addition of citric acid to the syrup used in canning cherries and prunes were also studied. pH values of some thirty varieties of strawberries were estimated in 1928 and 1930. The author discusses therefore the effect of varietal differences and of ripeness in the different fruits as also of the addition of 0.5% citric acid. He also tabulates results of pH analysis of 19 imported canned fruits of known origin. Further work is in progress.

1321. GILLESPIE, T. G. 664.84 : 632.3
A study of the growth of mixed organisms in canned vegetables.
Annu. Rep. Fruit Veg. Pres. Sta., Campden, for 1935-1936, 1937, pp. 21-9.

Some physical and bacteriological methods of testing for leaks are outlined. A method of inoculating processed cans with bacterial suspensions is described, by which no air is admitted to the cans. An account is given of some preliminary experiments on the growth of mixed cultures of bacteria in cans. [Author's summary.]

1322. HORNER, G. 664.84.036.5 : 581.192
Progress report on the mineral content of canned vegetables. I and II.
Annu. Rep. Fruit Veg. Pres. Sta., Campden, for 1935-1936, 1937, pp. 30-3, and
Ibidem for 1936-1937, 1938, pp. 51-6, bibl. 2.

In the first report the author compares the analysed mineral content of home cooked and of canned peas, stringless beans and carrots with that of the untreated products. He finds that considerable and similar loss occurs in both processes, thus 45-47% of potassium was lost and 24-26% of phosphates were lost in these processes. Losses on blanching are smaller but still important. Further details are given in the second report of mineral content of peas, beans, carrots and potatoes, special attention being paid to losses during the blanching process. Figures are given of the changes in the CaO , MgO , K_2O and P_2O_5 content after home cooking (i.e. cooking in a pan) and after canning. Losses on canning are found to be slightly greater. It is noted that considerable loss of potassium and some loss of phosphate occurs during blanching and further losses of all constituents are occasioned when the covering liquid is discarded.

1323. ADAM, W. B., AND SIDAPPA, G. S. 664.84.656.047 : 581.192
The composition and texture of dried peas. I.
Annu. Rep. Fruit Veg. Pres. Sta., Campden, for 1935-1936, 1937, pp. 34-50, and
 ADAM, W. B.
The composition and texture of dried peas. II.
Ibidem for 1936-1937, 1938, pp. 41-50.

In the first report the authors give details of the manurial treatment applied to the fields where the peas were grown, of practical canning tests and of the composition of dried peas after canning. Chemical analyses indicate that there would not appear to be any direct relationship between the figures obtained and the observed differences in the canned product except possibly as regards that associated with the phosphate content of the ash or the phosphate-calcium oxide ratio. Treatment with artificial fertilizers did not influence the texture of the peas appreciably and this would appear to be influenced chiefly by the rate of drying in the field. The observations recorded in the second report confirm the opinion that the texture of harvested peas is virtually unaffected by the application of artificials. They also show, however, that the application of fertilizers alters the mineral composition of the peas, the direction and extent of this alteration depending on whether the land has been previously treated with lime. The addition of salt to the land has a marked effect on their mineral composition. Early cutting and rapid drying tend to give peas a firm texture and low swelling properties.

1324. HORNER, G. 635.1/7 : 631.56
The losses of soluble solids in the blanching of vegetables.
Annu. Rep. Fruit Veg. Pres. Sta., Campden, for 1936-1937, 1938, pp. 37-40, bibl. 2.

The vegetables studied were fresh peas, stringless beans and carrots. Blanching in water for 3 minutes, 6 minutes or 7 minutes was compared with blanching in live steam for 3 minutes. The comparable effects on the sugar and nitrogen content of the product are described and the losses tabulated. Steam blanching caused much smaller losses of these substances than water blanching and the amount of shrinking was also less.

1325. ADAM, W. B., AND HORNER, G. 664.84/85.036.5 : 546.811
The presence of tin in canned fruits and vegetables.
Annu. Rep. Fruit Veg. Pres. Sta., Campden, for 1936-1937, 1938, pp. 24-36,
 bibl. 10.

The authors after discussing previous work on the subject of tin contamination note the improvements made in the container by lacquering. They give tables showing the tin content of a number of canned fruits stored at different temperatures in plain and lacquered cans for different lengths of time. They consider that previous work has shown that the risk of chronic tin poisoning from canned food is extremely remote. Their own figures show, however, that fruits

and vegetables in lacquered cans seldom nowadays contain more than 40 mg. tin per kg. even after long storage [which is very far below any possible danger limit—Ed.]. This is the figure for total tin in the product but the amount of soluble (i.e. the important) tin is unlikely to exceed half these amounts. Modern developments disclose a possibility of further reducing tin content almost to nil.

1326. ADAM, W. B., AND STANWORTH, J. 664.8.036.5

The effect of internal pressures on the volume of cans.

Annu. Rep. Fruit Veg. Pres. Sta., Campden, for 1935-1936, 1937, pp. 62-70, bibl. 2, and

The measurement of the internal capacity of cans.

Ibidem for 1936-1937, 1938, pp. 57-67.

These are two additional articles by the same authors dealing with investigations into can capacity and pressure. Two have been issued in previous reports, viz. Investigations of the pressures produced in cans during sterilization, *Ibidem for 1931-1932*, p. 44, and Measurement of vacuum in sealed cans, *Ibidem for 1933-1934*, p. 74.

1327. WIDMER, A. 663.813

Vereinfachung der Bestimmung des Klärbedarfs bei Herstellung von Süßmosten und Sirup mit "Filtral" Tabletten bezw. mit dosiertem "Filtral T". (The use of "Filtral tablets" or of "Filtral T" capsules to determine the degree of clarification necessary in unfermented fruit juices and syrups.)

Schweiz. Z. Obst- u. Weinb., 1938, 19 : 376-9.

Tests of the amount of clarification needed by various fruit juices and carried out later (in Switzerland) by the filtration enzyme powder known as Filtral have been greatly simplified by the use of two novelties, viz. Filtral tablets, and Filtral T capsules. Both contain known amounts of the clarifying substance and preliminary tests with them can determine the amount of filtral which will in each case be necessary for clarification of the juice in bulk. A brief account of their use is given.

1328. RIBÉREAU-GAYON, J., AND PEYNAUD, E. 634.851-1.547.6

Un essai de passerillage provoqué des raisins. (The use of heat to mature grapes prior to wine making.)

C.R. Acad. Agric. Fr., 1938, 24 : 535-44.

The process of "passerillage" consists of warming undamaged grapes at a low temperature, i.e. below 40° C., by a current of hot air or by merely placing them in a warmed place. The authors recount experiments made by them with red Petit Verdot grapes in 1937, in which samples of grapes were submitted to a temperature of 35° for 48 hours and for 5 days and were afterwards chemically analysed. Their results indicate that such treatment, which can be carried out at but small cost, provides a method of deacidifying the grapes and of enriching their juice and should help the viticulturist considerably to increase the quality of his wine, especially in years of inadequate ripening.

1329. FERNANDO, M. 633.74-1.56

The fermentation and curing of cacao in Ceylon.

Trop. Agriculturist, 1938, 90 : 191-9, bibl. 8.

The respective cacao drying techniques of the large estates and of the small holders of Ceylon are discussed and compared. In Ceylon the sweating is regarded merely as a means of getting rid of the pulp. It is argued by the author that with a sweating process as short as that adopted by the small holders the importance of slow and careful drying is supreme. Internal enzyme reactions initiated in the sweat box can proceed and conclude satisfactorily only under conditions of protracted and well regulated drying. Attempts at improving the small holders' technique should include devices for retarding the rate of dehydration. The final moisture

content, if the risk of subsequent mould formation is to be avoided, should not exceed 8%. Since small scale fermentation always produces difficulties the adoption of co-operative fermentaries under expert supervision is suggested, such as have been successfully established in Trinidad and Tobago.

1330. TERGAST, G. C. W. C. 658.8
Het kunstmatig drogen van copra. (**Artificial drying of copra.**) [English summary.]
Landbouw, 1937, 13 : 128-53, bibl. 4.

Four practicable methods of copra drying, suitable for use by native growers are described. These respectively make use of zinc ovens,* closed wooden ovens heated with dry coconut shell fuel, kilns heated with coconut shell charcoal, and, on a larger scale, ovens with an iron drying plate, a stone flue and smoke passage. The charcoal method is considered the best for the smallholder, as it requires the lowest capital expenditure and the least supervision. The paper is well illustrated with plans and photographs.

NOTES ON BOOKS AND REPORTS.

1331. WALTER, U. 31 : 634 + 635
Der Gartenbau der Welt. (**World horticulture.**)
Gärtnerische Verlagsgesellschaft Dr. Walter Lang K.-G. Berlin, 1938, pp. 64,
RM. 2.50.

This statistical survey based on information derived from the International Yearbook of Agricultural Statistics 1935/36, various national yearbooks and statistical bureaux, does give a very good idea of what horticulture is practised and of the respective importance of the different crops in all parts of the world. Particulars are also given of horticultural production in Germany. Other details provided are the number of trees, the area and production in the case of all the more important fruits of commerce and the area and production of different vegetables in the different countries. The areas devoted to flower growing are also noted. Any particular trend in the production of fruit, flowers or other horticultural objects in the different countries is also briefly discussed. It should prove a useful reference book.

1332. TWELFTH INTERNATIONAL HORTICULTURAL CONGRESS. 634/5 : 06 + 05
Horticultural organizations and periodicals of the world.
Bücherei des deutschen Gartenbaus, Berlin NW 40, Schlieffenufer 21, 1938,
pp. 310, RM. 1.50.

It is not absolutely clear whether public horticultural institutes, horticultural establishments of a scientific nature and those to which the government makes contributions are entirely banned from the list of organizations given here, but judging from the English list of societies this would appear to be the case. Apparently, however, there is no hard and fast rule on the subject nor on what journals are to be included or omitted. Thus we find listed *Hilgardia* and *Better Fruit*, but not *Contributions of the Boyce Thompson Institute* nor *The California Citrograph*; *Scientific Horticulture*, *The Gardeners' Chronicle* and *Annali di Botanica* occur, but not the *Journal of Pomology*, the *Journal of the Ministry of Agriculture* or *Annals of Botany*. The editor asks to be informed of omissions and it does seem that this work which is at present—may we say—"full of lacunae" might well form the basis for an extremely useful and informative work. Its price is negligible and it is up to horticulturists to get a copy and send in their suggestions for additions.

* A larger but more solid kiln of the same type but made of iron is described by Perk, A. *Ibidem*, 13 : 487-91.

1333. ZANDER, R., AND HECKEL, M. 41.3 : 634/5
Dictionary of horticultural terms in four languages.
 Bücherei des deutschen Gartenbaus, Berlin NW 40, Schlieffenufer 21, 1938,
 pp. 419, RM. 5.

This small dictionary of French, German, Italian and English horticultural terms was brought out by the 12th International Horticultural Congress, Berlin, August 1938. It is of a convenient size to be carried in the pocket and should prove useful to the travelling and studious horticulturist. It does not claim to include all horticultural terms, in fact it is expressly stated that in order not to make the book too large or expensive selection was restricted to words frequently occurring in the Congress reports. It has the flaws inherent in any work prepared quickly just prior to a conference and it is easy to turn up say a well-known English term like "top-working" or "growth promoting substance" and not to find it, although if one looks up the German equivalent in the latter case at least, i.e. Wuchsstoff, the English equivalent is duly given. The editor asks for comments on words used erroneously and presumably a number of similar minor flaws will be remedied in future editions. Meantime it does seem adequately to fulfil the need for a small cheap dictionary of common horticultural terms.

1334. ELLIS, C., AND SWANEY, M. W. 663.61 : 581.084.1
Soilless growth of plants.

Reinhold Publishing Corporation, New York, 1938, pp. 155, 13s. 6d.

This book is an attempt to stimulate popular and commercial interest in the culture of plants in mineral aggregates, and water by the use of nutrient solutions, methods which have long been used by the plant physiologist for the purpose of strictly controlled experiments. The eight chapters are headed as follows: Chemistry of plant life; growing in mineral aggregates; growing in water; household plant culture; commercial aspects; special chemicals; common detriments; nutrient formulas. The entertaining language makes the book very easy reading, but the obvious enthusiasm of the authors has occasionally led them to paint an over-optimistic picture, with the consequent danger that the unwary might be led to attempt large scale crop production by the solution method before fully examining the difficulties. It still remains doubtful whether such good growth can be obtained by solution cultures as by the use of fertile soil under the same conditions and in this connexion the interested reader is advised to consult a recent article by Templeman and Watson, *J. Minist. Agric. Lond.*, 1938, 45: 771. This book will probably encourage many amateur experimenters to attempt this novel method of plant culture, and provided they proceed with due caution, it will have served a useful purpose.

H.L.P.

1335. KEMMER, E., AND SCHULZ, F. 634.1/7-1.4+1.8+1.67
Grundlagen der Bodenpflege im Obstbau. (Principles of soil management in the orchard.)

Paul Parey, Berlin, 1938, pp. 240, RM. 14.20.

The reader will look in vain in this book for the solution of all his problems of soil cultivation and manuring in the orchard. He will, however, be considerably helped towards an appreciation of the real nature of those problems and the avoidance of deductions from faulty premises. The book is divided into three parts, namely, manuring, soil management and water problems. *Manuring.* The authors here deal with experimental work carried out largely by German, American and English workers and note the difficulties inherent both in pot and in field trials. As regards the latter they note the desirability of using uniform rootstocks and consider that the precocious and dwarfing character of Malling IX stock makes it very suitable for the purpose. Further they stress the necessity in any field trials of paying the greatest attention to factors involved other than differences in manurial applications. They then consider at some length the amounts of the various nutrients which can be expected to be present in different types of soil and their effect on growth. Next they turn to experiments with different fruit varieties, on soil reaction and on the need for organic matter in the soil. Finally they deal with fertilizer

and with labour requirements. In addition a table is given showing the amount of N, P or K which will be provided by varying amounts of some 13 fertilizers in common commercial use. *Soil management.* In the second part of the book on soil management the authors consider first the effect on root growth and on soil consistency of common cultural operations. Some fifty odd pages are then devoted to a consideration of the effects of undercrops and the attention given to them on fruit trees and vice versa. *Water problems.* In the last part of the book water problems are considered and the comparative effects of the flooding, furrow, underground and overhead systems of applying water are discussed. The whole work is copiously and clearly illustrated and documented, the references being given at the foot of each page.

1336. KERVÉGANT, D. 633+634+635

Les plantes utiles et ornementales de la Martinique. II. Plantes fruitières.

(Useful and ornamental plants of Martinique. II. Fruits.)

Bull. agric. Martinique, 1937, 6: 1: 1-142.

A number of tropical and subtropical economic fruit plants are described and notes given on their cultivation in Martinique. The citrus section contains descriptions of all the citrus varieties grown locally (excluding a few recent importations which are named only). One or two of these types are probably developments peculiar to the island, others have a long horticultural history and are no longer grown commercially and a few are leading commercial kinds of the present day. Of other fruits the better known kinds are treated at length, special attention being paid to methods of vegetative propagation. The vegetative propagation of the less common species is either not mentioned or the scant information is quoted from Wester, the universal provider in matters of this sort, of whom it might be truly said, *Si monumentum requiris circumspice* at almost any article on tropical plant reproduction. There is no bibliography and occasional bald references to authors in the text merely increase the sense of frustration engendered by the discovery that there is also no index and that the plants are arranged alphabetically throughout the book under their French popular names. This practice the English reader, who consequently has to do a bit of hard thinking, will undoubtedly condemn. We frankly admit that we had not any idea that "kénette" was *Melicocca bijuga* or that "merises" referred to species of *Flacourtia*, nor, we may add, had our French dictionary.

1337. NICOL, H. 577.15.04

Plant growth substances.

Leonard Hill, Ltd., London, 1938, pp. 108, 6 bibliographies, 3s. 6d.

This is a useful little book for anyone wishing to obtain a rapid insight into some of the recent research on plant growth substances and the applications of this knowledge to horticultural practice. After a short introduction the author goes on to deal with the use of commercial growth substances for rooting cuttings; synthesis of growth substances; results of scientific work on the effects of synthetic growth-substances; growth substances from natural sources; occurrence of growth substances in urine; chemistry in relation to growth; classification and nomenclature of growth substances and the identification of growth substances and some substances related to them. In the introductory chapter the author confesses that he is not a plant physiologist and accordingly the main interest of the book to the research worker lies in the sections on the chemistry of the growth substances, the enumeration of chemical tests for these substances in the chapter on the identification of growth substances being especially useful. The statement that "the only commercially available growth substances the horticulturist and amateur gardener need trouble about, are indole-acetic acid and phenylacetic acid" in the chapter on the use of commercial growth substances in the rooting of cuttings is now out of date, as indolebutyric acid and α -naphthalene acetic acid are among the most potent root-formers, and are already widely used in practice. The modest price of this book should put it within the reach of all interested in this rapidly advancing field of botanical research.

H.L.P.

1338. WENT, F. W., AND THIMANN, K. V.

577.15.04

Phytohormones. Experimental Biology Monographs.
Macmillan Co., New York, pp. 294, figs. 62, bibl. 559, \$4.00.

This book is a very thorough summary of the knowledge which has led to the development of the idea that correlations in plants are controlled by the influence of special substances and it is written by two of the foremost workers in this branch of plant physiological research. These substances have been termed by various writers plant growth substances, plant hormones, auxins, Wuchsstoffe, and growth-controlling substances; the authors prefer to adopt the term phytohormone and in the introduction they accept the definition of hormone as:—a substance which being *produced* in any one part of the organism, is transferred to another part and there influences a specific physiological process. It is therefore perhaps a little confusing to the reader that in subsequent chapters the term phytohormone or auxin has been taken to cover many different substances, while in Chapter VII it is pointed out that only in the case of auxin has indirect evidence been obtained that it actually occurs in higher plants. This review is restricted to deal only with the hormones of higher plants, and after outlining the scope of the work in the introductory chapter, the authors proceed to discuss in subsequent chapters the development of the hormone concept; the technique of auxin determinations; the formation and occurrence of auxins; the relation between auxin and growth; auxin transport and polarity; the chemistry of the auxins; the mechanism of the action; the growth of roots; tropisms; root formation; bud inhibition; other activities of auxins, and general conclusions. To the horticulturist the main consideration is what advantage in practice can be obtained by the use of these substances, and while much stress has rightly been laid on the fact that plant physiologists must beware of drawing hasty conclusions about the behaviour of growth controlling substances in the normal plant from experiments in which high concentrations of synthetic substances have been applied to plants or plant parts, it is nevertheless true that only by such experiments have many results of distinct practical importance been obtained. The book is very clearly and interestingly written, and enables even the uninitiated to obtain quickly a good grasp of this fascinating field of botanical research. It is to be hoped that the distinguished authors will bring out revised editions of this book from time to time to keep pace with the very rapid progress which is now being made.

H.L.P.

1339. FISHER, R. A., AND YATES, F.

51 : 581.084

Statistical tables for biological, agricultural and medical research.
Oliver & Boyd, London, 1938, pp. 90, 12s. 6d.

From time to time since the first numbers of *Horticultural Abstracts* there have appeared therein summaries of papers dealing with the statistical aspects of the many-sided problems of horticultural research. Many of these papers describe methods by which the research worker, having designed his experiments in accordance with certain fundamental principles, may himself analyse his numerical results. As new statistical methods have been evolved to meet the needs of increasingly complex research, statisticians have provided tables of various mathematical functions to assist in and simplify their use. Hitherto these tables have been scattered in various publications, sometimes not very accessible to those who would wish to use them. It was thus high time for a new book of statistical tables which would collect in one volume those now commonly recommended. Many of these have originated from Rothamsted and it is, therefore, especially suitable that Professor Fisher and Mr. Yates should now meet the demand which they have to a large extent created. In this volume will be found a very representative collection of tables now in ordinary use, both by statisticians and scientists who cope with their own statistical problems, and some that are new. Some of the more well-known ones, such as those of "t" and "z" are now considerably extended. Noteworthy additions are the tables of the Variance Ratio (known in America as "F"), the various transformation tables, including Bliss' Probabilities for the transformation of the Sigmoid Dosage Mortality Curve to a straight line, and those for use in the calculation of orthogonal polynomials. A novel departure is the inclusion of sets of latin squares, which will be of value to those whose work calls frequently for this

type of experimental design. Finally there are the usual mathematical tables such as logarithms, squares, square roots, reciprocals, factorials, natural sines and tangents. Those to whom calculating machines are still a luxury to be dreamt of only, will appreciate the sympathetic care with which these last tables have been assembled. Indeed, throughout, the book shows clearly that these tables have been regularly used by the authors and that personal experience has dictated the mode of presentation. To complete the book there are six pages of random numbers and a very comprehensive collection of mathematical constants, weights and measures. It goes without saying that a book of this nature can only be used by those who have at least some knowledge of the methods of statistical analysis involved. Nevertheless the authors, in their introduction, have done much to assist the user by clear explanations of the scope of the tables and examples of some of the uses to which they may be put. Altogether a book of which both the authors and printers may well be congratulated and for which the world of biological research may well say "Thank you!"

T.N.H.

1340. KENYA, DEPARTMENT OF AGRICULTURE. (McDONALD, J. A., Editor.) 633.73
Coffee in Kenya.

Government Printer, Nairobi, 1937, pp. 210, bibls. in text, \$5.00.

This work embodying the results of research and observational work on coffee in Kenya for the past 12 years is the joint production of the staff of the Scott Agricultural Laboratories, the Agricultural Economist of the Department of Agriculture, Kenya, and the Director of the British East African Meteorological Service. The coffee grown in Kenya is almost exclusively arabica. The book is not to be regarded as a text book on coffee but as offering some elucidation of the problems to be met with in Kenya. It is divided into 5 parts under these headings: Climate of the coffee areas in Kenya—Coffee soils and their treatment—Cultural practice and factory treatment—Insect pests of coffee—Diseases of coffee—Economics. In each part the treatment is comprehensive and the illustrations are illuminating and to the point.

1341. IMPERIAL ECONOMIC CTTEE., LOND. 658 : 634.1/8 + 635.1/7 + 635.9 + 635.944
Fruit supplies 1937 including vegetables, flowers and bulbs.

H.M. Stationery Office, Kingsway, London, W.C.2, 1938, pp. 102, 2s. 6d.

This eighth annual review of fruit supplies in the United Kingdom deals with the imports of all important quantities of fruit, vegetables, flowers and bulbs brought into England in the year 1937. Figures are also given of imports of raw fruit into Eire, Germany, the Scandinavian countries and the U.S.A. Notes appear on the following fruit seasons for 1937-8. Canada, North American apple, South African deciduous, Australian and New Zealand deciduous, Palestine citrus, Spanish orange, on the summer orange season 1937, and the Almeria grape season 1937.

1342. COUNTY ARMAGH CTTEE OF AGRICULTURE. 634/5
Report of horticultural instructors.*

37th Annu. Rep. County Armagh Cttee Agric., 1938, pp. 69-95.

Small scale experiments, the results of which are here given, embraced: the use of combination washes including mineral oil sprays for capsids, aphids, apple sucker and caterpillar; scab control with bordeaux and lime sulphur; raspberry, black currant and strawberry varieties; manurial trials on raspberries and black currants; the prevention of carrot fly by the use of crude naphthalene among the young plants. Instructional notes are also given on the cultivation of rhubarb.

1343. AUSTRALIA, C.S.I.R.† 634/5
Eleventh annual Report of the C.S.I.R. for the year ended 30th June, 1937, 1938, pp. 89, Govt. Printer, Canberra, 3s. 9d.

Fruit investigation. Notes are given of expenditure on research under the apple and pear grant, dieback survey in the apple areas of the Commonwealth, physiological disorders of fruit

* J. Hagan and J. Scrimgeour.

† Council for Scientific and Industrial Research.

in the field and during storage, investigations in the irrigation areas, rootstock investigations with regard to apples, pears and plums in Queensland. *Irrigation Settlement investigations*. A. Merbein Viticultural Research Station, Victoria. Problems under investigation include the following: soil irrigation and drainage, effect of irrigation on salt content of soil, growth problems of the sultana and biennial bearing, fruit processing. B. Griffith Citricultural Research Station, Murrumbidgee Irrigation Area, N.S.W. Studies include green manuring, control of irrigation water, fertilizer experiments, biennial bearing in Valencia Late orange, cold storage of oranges, frost protection. *Food preservation investigations*. Those noted which concern fruit are black end and squinter disease of banana, "rubbery" banana, citrus storage at Newcastle and Griffith, N.S.W., Melbourne and Adelaide, citrus packing house hygiene, colouring citrus fruits, storage of apples, pears, peaches, plums, nectarines, grapes and passion fruit. *Commonwealth Prickly Pear Board*. The great progress made in controlling prickly pear by *Cactoblastis cactorum* is discussed. It may be noted that this report does more than merely note investigations in progress. It actually sums up progress made in the course of the year in question in the various research programmes, although necessarily confining itself more or less to results.

1344. BERMUDA.

635.1/7

Report of the Department of Agriculture of Bermuda for 1937, 1938,
pp. 55.

During the year factors involving wastage in Bermuda vegetables were investigated. Field conditions encouraging the spread of fungous diseases among the crop plants were the local practice of close planting to minimize wind damage, whereby the already high relative humidity is increased, the absence of frost and the lack of systematic crop rotation. The time of appearance of diseases of potato and celery, *Phytophthora* and *Septoria* respectively, appears to be in part correlated to certain environmental factors such as the height of the water table. Carrots were affected in the field by *Sclerotinia sclerotiorum* and this was spread to stored carrots through careless treatment whereby portions of basally infected leaves were left on the crown and acted as focal points for the spread of the fungus in storage or transit. Principal causes of celery depreciation were water loss caused by undue exposure after harvesting and certain fungal and bacterial rots. In packed celery the loss of water from the heads at the periphery of the crate was more than double the loss of those at the centre. Trimming off the green tips, compulsory in shipped celery, was found to reduce water loss and improve quality.

1345. BIHAR.

634.441 + 634.571 + 634.651

Report of the Agricultural Department of Bihar, April 1936-March 1937, 1938, pp. 62 + Suppl. pp. 5. As. 10.

The section dealing with fruit research outlines the course which the newly initiated work of the fruit research scheme is to follow, but results cannot be expected for 2 or 3 years. The work will be confined at first to detailed studies on mangoes, litchies and papaya.

1346. BRITISH COLUMBIA.

634/5

Thirty-second Annual Report of the Department of Agriculture for the year 1937, 1938, Victoria, B.C., pp. 108.

The general report on production and markets is followed by that of the Provincial Horticulturist who, after dealing with production, turns to demonstration work and gives brief accounts of work on the following subjects: lettuce varieties, raspberry varieties, the control of apple scab, codling moth, drought spot, European red mite, and mealy bug, as well as fertilizers and inspections. The next section is the report of the Provincial Plant Pathologist. Horticultural diseases or phenomena examined by him and commented on included snapdragon rust, cracking of cherries by rain (and possible remedy), soil sterilization for greenhouses, anthracnose of apples.

1347. CANADA. 63 : 581.084
Twentieth Annual Report of the National Research Council of Canada, 1936-1937, Ottawa, 1937, pp. 182, 75 cents.

Work noted in this report of particular interest to horticulturists includes : Investigation on the cause and prevention of taints acquired by apples and other food products during transit and storage—Maple products—Plant alkaloids—Plant hormones (a method has been evolved for the cheap synthesis of α -naphthyl acetic acid)—Oil seed research (flax seed and sunflower seed)—Preparation of powdered apple by desiccation in vacuo.

- 1348 CAWTHRON. 634/5
Annual Report of the Cawthron Institute, 1937, 1938, Nelson, N.Z., pp. 24.

A list of publications shows where full details can be obtained of the work in progress. Horticultural investigations noted here include the following : Tobacco mosaic and tobacco seed disease ; internal cork of apples and the value of borax ; apple manurial trials as affecting growth, crop and storage quality ; mouldy core and eye rot of apples ; the *Aphelinus mali* parasite of woolly aphid, the Dryinid parasite of the apple leaf hopper, the raspberry bud moth ; tomato cloud disease, tomato varieties, biological control of ragwort, piri-piri and gorse.

1349. DUTCH EAST INDIES. 633/5
Verslag over het jaar 1937 van het Algemeen Landbouw Syndicaat enz.
(Report for 1937 of the Algemeen Landbouw Syndicate, etc.), Ruygrok & Co., Batavia, 1938, pp. 218.

An annual report of the activities of the research stations for perennial crops of the Dutch East Indies issued by their controlling syndicates. Brief notes are given of the numerous experiments in progress.

1350. FLORIDA. 634/5
Annual report for the fiscal year ending June 30th, 1937, of the Agricultural Experiment Station, Gainesville, pp. 184.

Among a multitude of projects of interest to horticulturists, of which short notes are given here, the following are noted : *Chemistry and soils*. Bronzing or copper leaf of citrus. Celery nutrition. Vitamin content of fruits and vegetables. *Entomology*. Root knot (eelworm) eradication. Beneficial insects. Thrips of onion and gladiolus. Pepper weevil. *Horticulture*. Pecan soils, fertilizers, cover crops and varieties. Tung oil propagation and cultivation. Citrus juice and pulp preservation. Citrus cold storage.* Citrus maturity studies. Soil reaction and growth of vegetables. Green manuring and growth of vegetables. Fumigation of horticultural produce. *Plant pathology*. Fungus diseases of water melons. *Clitocybe* root rot of citrus and other woody plants. Factors affecting decay in citrus fruits. A bark disease of Tahiti limes. Fruit rots of grapes. Seed treatment to control seed and soil-borne diseases of plants. Gummosis and psorosis of citrus. Celery sprays. *Citrus Station*. Dieback. Bud selection. Citrus soils. Physiology of fruit production. Melanose and stem end rots. Effect of zinc and other unusual minerals on the growth of horticultural crops.

1351. GEISENHEIM AM RHEIN. 634/5
Bericht der Versuchs- und Forschungsanstalt für Wein-, Obst- und Gartenbau für das Rechnungsjahr 1936, 1937, pp. 36. **(Annual report of the Geisenheim Horticultural Research Station for 1936.)** Paul Parey, Hedemannstr. 28, Berlin SW 11, pp. 36.

Brief reports are given of the activities of the various departments or sub-stations and a list of the publications by the staff is given at the end of each section. *Director's Laboratory*. Pear scab and other species of *Venturia*. Effect of pest control poisons on the plant cell. The

* See *H.A.*, 8 : 280, 281, 282.

search for a primin-free primula. Pollination experiments. Walnut propagation. *Plant Disease Institute*. Pharmacology of poisons used in insect control. The effect of earth rays on plants (i.e. the influence on plants of the presence beneath them of underground streams and especially of the points where such streams cross). Vine disease and chemical remedies. *Botanical Institute*. Investigations on yeasts and other ferments. Pollination. *Institute for soils and manures*. The effect of pH reaction in the vineyard. Viticultural surveys. Phosphates in vineyard. *Vegetable and Fruit Products Institute*. Sulphurous acid determination in unfermented fruit juices. Removal of acidity from fruit juice. Trials of a new sterilizing apparatus. Sterilization by ultraviolet rays. *Vine Breeding Station*. True line selection in European and American vines. Segregation in European vines. Hybridization. Improvement of grafting technique. *Silk Department*. Vegetative propagation of the mulberry by cuttings, layers and the use of stoolbeds. Selection of the mulberry. Experiments on production of different types of silkworm and on influence of feeding on weight of cocoon. *Vine Propagation Station*. Transpiration. CO₂ assimilation. Stomata examination. The effect of growth substances on grafted vines. *Institute of Biochemistry and Wine Chemistry*. A colorimetric method of nicotine determination. The addition of colouring matter to unfermented juices. Determination of arsenic in minute quantities. The extraction of fat and protein from micro-organisms.

1352. HAWAII.

634.1/8

Report of the Hawaii Agricultural Experiment Station for 1937,
1938, pp. 117.

Propagation of the litchi (*Nephelium Litchi*) had hitherto been confined almost exclusively to inarching or marcotting with but very little success from grafts. It was found, however, that by ringing the intended scions three weeks before use and forcing a high accumulation of starches the percentage of successful grafts was raised to 80%. Similar results were obtained with *Macadamia*. These results should be of considerable significance and widespread application especially where seasonal changes giving rise to accumulation of reserves do not occur. Topworking was successful with *Macadamia* when the scions were worked on the sucker shoots arising from the headed back trees. Attempts to graft direct on the main trunk or branches by any of the ordinary methods had always failed. Papaya fruit picked green and held for twelve days at 32°-34° F. failed to ripen when removed to room temperature. When picked firm ripe with practically full colour fruit was preserved in its original condition at 32°-34° F. for twelve days and was maintained for a further seven days at 50° F., but on removal to room temperature it ripened and broke down rapidly.

1353. ILLINOIS. (MUMFORD, H. W., Director.)

634.1/8

A year's progress in solving farm problems of Illinois.

49th Annu. Rep. Ill. agric. Exp. Sta. for year ended June 30, 1936, 1937,
(Horticultural investigations on pp. 243-84).

Among projects in progress of general interest the following may be noted :—*Comparison of 5 different cover crop treatments for apple orchards*, viz. (1) permanent blue grass (timothy) sod without nitrogenous fertilizers, (2) ditto but with nitrogenous fertilizer, (3) clean cultivation early in season followed by soybeans or cow peas, (4) clean cultivation early in the season followed by native vegetation, and (5) permanent legume cover such as sweet clover or lucerne. The effect on moisture content of the soils will be observed closely. *Comparison of rootstocks for cherries*. Early Richmond and Montmorency trees on morello stocks came into bearing earlier than those on mahaleb, but owing to the greater size of tree made on mahaleb, they were soon overtaken in crop figures. Neither rootstock was appreciably injured by the severe winter of 1935-36. No appreciable difference has been seen in the behaviour of Lyons, Seneca and Montmorency trees on mazzard as against mahaleb stocks in the first few years prior to bearing. *A strawberry resistant to brown stele root rot*. [Probably due to a *Phytophthora* sp.] The variety Aberdeen is found to be resistant.

1354. INDIA, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH. 634/5
Agriculture and animal husbandry in India. Manager of Publications,
 Delhi, 1937, pp. 411, 7s. 9d.

The report is concerned with every kind of agricultural activity. Only those on which experimental work of interest to this Bureau is in progress are mentioned below. *Tobacco.* Work is in progress or about to be initiated under the Imperial Agricultural Research Institute into the chemical changes in the leaf as a result of curing, bulking and storage. The control of weevils and the possibility of artificial maturation, the effect of environment on the chemical composition and quality of Indian grown cigarette tobacco, are also the subject of research. An all India survey of tobacco-marketing is nearing completion. Experiments on 5 types of leaf curl are in progress [for reports on this work see *H.A.*, 1937, 7: 1014, 1015—Ed.]. *Coconut.* In Madras artificial pollination did not increase the yield of coconut. Plots receiving ammonium sulphate and ashes yielded 23% more than the control. High yielders produced more copra per nut than poor yielders. *Tea.* Experiments at Tocklai Research Station are discussed. An experiment which in 1935 had lasted 16 years consisted of applying the same fertilizer annually. Sulphate of ammonia gave the largest crop over no treatment, sinews and hides, nitrate of soda, rape cake, green mulch of *Tephrosia candida* in ascending order of yield per acre. The effect of sulphate of ammonia was to increase soil acidity, and improve the friability of the soil. *Tephrosia candida* green mulch provides a rapidly and efficiently available nitrogen. No benefit would be derived from composting such material. Continuous nitrate of soda spoilt the tilth of the soil in later years, though at first it was as efficient as sulphate of ammonia. The continual use of mineral manures, far from depleting organic matter in the soil has in another experiment been found to increase it, because of the increased amount of leaf-fall and prunings which through their agency are available for return to the soil. Whether sulphate of ammonia is forked in or left on the surface the manurial effects are the same. Spraying with 1% burgundy mixture and lime sulphur controls black rot. *Fruit.* A number of provincial and state fruit experiment stations are in course of development and there is much activity in the search for and propagation of suitable rootstock varieties and for the most suitable budding and grafting method for the different fruits. In Bihar August planting of grafted mangoes resulted in a reduced mortality compared with planting in February. The growth of mango trees was better under clean cultivation than under grass. Under clean cultivation there is a later leaf fall, a later flowering and fruit setting, longer internodes per shoot and a greater leaf area. During studies of the problem of periodicity in mango it was found that there was a specific hour and day for the maximum anthesis in each of the varieties examined. High temperature and low humidity prior to flower bud initiation hastened the flowering period which was also profoundly influenced by the flowering and fruiting of the previous season. Smudging, root pruning and ringing suppressed vegetative growth and increased flowering. Artificial feeding with Sachs' nutrients accelerated growth and flowering. Irrigation after the formation of fruit panicles reduced fruit crop and increased size of fruit. In Bombay yield of bananas was increased by a mixture of farmyard manure and castor cake, each giving 0.4 lb. nitrogen per tree. In the Punjab ringing grape vines hastened maturity by 15 days. Of 10 systems under trial the umbrella system of training grape vines was found to be the best. In Burma the most suitable storage temperature for mangosteens was between 40°-60° F. In the Punjab fruit wrapped in waterproof butter paper kept one month longer than unwrapped fruit. Investigations still incomplete in various localities are also mentioned.

1355. IOWA. (BUCHANAN, R. E., Director.) 634/5
Report on agricultural research for the year ending June 30, 1937. Part I,
Project reports, publications, staff, financial statement.
Annu. Rep. Ia agric. Exp. Sta. for fiscal year ending 30 June, 1937, pp. 263.

Brief notes are given on pages 173-91 of projects which include the following: Pæony and iris varieties. Growing uniform rootstocks for standard apple varieties. Development of new, especially dwarfing, stocks for apples. Soil management for apple orchards. Apple storage temperatures. Apple breeding. Pear breeding. Plum breeding. Peach improvement. Fruit

variety studies. Crossing black raspberries to get immunity to anthracnose. Plant propagation with an eye to use in erosion control. Respiration in picked Jonathan apples. Strawberry selection for south-eastern Iowa. Effect of stock-scion influence on apple production. Vegetative propagation of woody plants (apple) as associated with juvenile forms and adventitious buds. Rose stocks. Potato breeding. Asparagus culture. Storage of sweet potatoes. Manuring of sweet potatoes and musk melons. Wilt resistant water melons. Sweet potato breeding. Propagation of sweet potatoes. Musk melon improvement.

1356. LAUSANNÉ. (FAES, H., Director.) 634.8
Rapport annuel de la Station fédérale d'essais viticoles à Lausanne et Domaine de Pully 1936. (**Annual report of the Swiss federal research station for viticulture at Lausanne for 1936**), being reprinted from *Annu. agric. suisse*, 1937, pp. 1045-81.

This is a very brief account of the research activities at Lausanne and Pully during the year 1936. A list of articles dealing with the work in greater detail and published by the staff is given. Among many interesting notes found here we would draw attention to the following: A great increase in take of grafts on vine rootstocks containing Berlandieri blood was achieved by soaking the grafts for 2 or 3 days in water just before grafting and keeping the nursery bed very well watered directly after planting out. Covering fruits with a wax—now on the market as "cirfruit"—proved very successful as a method of keeping fruit in good condition and little inferior to that cold stored after 187 days. Investigations are being continued on the economic desirability of cultivating the castor oil plant (*Ricinus*) in French Switzerland. The Chemical Department has been busy testing the cause of faulty wines, soils, wines made from direct producers, ferments, wine making apparatus. It has also studied unfermented juice production, various wine making processes, new methods of analysis, the presence of arsenic in juice and wine, and has considered the economics of wine storage and bottling.

1357. MADRAS. 634.3 + 634.441 + 634.651
Annual Report of the Fruit Research Station at Kodur for the year 1936-7.
Report of the Madras Agricultural Stations for 1936-7, pp. 727-67.

This is the 2nd annual report of the newly formed fruit research station at Kodur, Madras. *Citrus*. Using seedlings of sour orange as stocks and a local sweet orange as scion striking differences were obtained in favour of leaving a thin strip of wood behind the shield bud compared with the common Indian method of inserting the bud after the removal of the wood. Bud break occurred 3 weeks earlier when the stock was headed back almost to the bud at time of budding instead of a month later when the bud shoots should be 2 inches long. Nevertheless in these early breaking buds subsequent shoot growth was markedly less than on stocks lopped a month after insertion. July and September were the optimum months for successful budding, June was distinctly unfavourable. The most rapid growth of bud shoots was in September. The most unfavourable months, March, June and November, were months of climatic extremes of either dry heat or heavy rainfall. Some interesting preliminary studies for rootstock selection including root studies of 8 varieties of possible stocks are described in some detail. Five of the eight varieties are referred to only by their vernacular names, or in the glossary as *Citrus* sp., their nature must, therefore, remain a mystery, and the report thereby loses much of its interest. However, a classification of the numerous local citrus varieties is in progress and possibly in the next report some kind of a glossary may be available. The classification is to be extended to other fruits. Success in transplanting seems dependent on the character of the root system, those varieties with an abundance of fibre in the upper soil layer being the most suitable. Raffia fibre is a more generally useful tie than waxed tape or banana fibre, the main defect of the raffia being its liability to untimely breakage or loosening during the hot weather. *Mango*. No correlation between size of fruit and/or stone and germination or vigour of seedling could be obtained. In the case of vigour it is suggested that the inherent variability of the seed parent may mask such influences. It was noted, however, that the seedlings from one particular tree excelled in vigour. July to September were the best months for inarching the mango.

Young seedling stocks of 3-4½ months were successfully inarched, their percentage of success being 62.5% compared to the 36.4% obtained with 12 months old seedlings. The data, however, are not sufficient to correlate age with degree of success. Transplanting 6 months old seedlings, with and without a ball of soil, to shaded nursery beds gave equally good results (over 80%). Inarched grafts could be successfully planted on their orchard sites immediately on separation from the parent, the usual custom being to keep them in their pots under shade for a time. In fact the grafts planted directly without nursing flushed many weeks ahead of those kept under shade. *Papaya*. Rapid loss of viability was shown in papaya seeds in so short a period as a fortnight. The method of determination of the sex of unfruited papaya trees by means of an iron indicator suspended by a thread over a leaf of the plant to be tested was the subject of experiment. The metal should show a circular motion over the female trees and a pendular motion over the males. On this occasion the instrument registered correctly 75% of the number of females and 82% of the number of males, a result sufficiently interesting to make further trials on a larger scale worth consideration. Distinction of male from female by difference in early vigour was found to be impossible.* A new transplanting tool for transplanting without root disturbance was given a trial. The tool consists of a circular blade of the shape and size of a 6 inch to 12 inch pot and is riveted to a long handle. The length of the blade is divided by a small longitudinal slit opposite the handle which enables it to be placed round and removed from the stem without hindrance from the branches. These implements which were of various sizes reduced the cost of transplanting by nearly half, more than doubling the speed per man for the work.

1358. MADRAS.

634/5

Report of subordinate Officers of the Department of Agriculture of Madras for 1936-7, 1938, pp. 182.

Most of these reports show that increased practical interest in fruit growing is being taken by the peasants as a result of the efforts of the Department of Agriculture. In experimental work at Kodur July to September are shown to be the best months for propagating the mango by inarching. For citrus budding July and August are the best months. Better results are obtained if the wood is left at the back of the bud shield than if it is removed. An excellent compost manure was obtained from the scheduled weed pest, the water hyacinth. Work on groundnuts at Coimbatore was directed to effecting improvement in yield and quality or a decrease in cost of production. Lack of dormancy in the groundnut reduces the yield as the nuts germinate in the ground before harvest. It was found that prolonged dormancy was a characteristic only of the spreading varieties and was only exhibited in those erect varieties which had the blood of spreading types in them. At Beypore good results have been obtained on the coconut demonstration plot by the sowing of cow-grain as a green manure crop at the beginning of the monsoon and ploughing it in at its flowering stage. It is a recognized practice to select seed from middle-aged palms. Experiments at Coimbatore showed that actually there were no differences in percentage of germination of seed nuts harvested from young, middle-aged or old palms, but that nuts from young palms germinated earlier and so had produced more leaves at a given time than appeared on comparable seedlings from older palms.

1359. MAINE.

634/5

Report of progress for year ending June 30, 1937.

Bull. Me agric. Exp. Sta., 387, 1937, pp. 157-62.

This report contains brief accounts of many investigations interesting to horticulturists. Among them are the following: *Apples*. Breeding for better late varieties. McIntosh strains and pollination. Storage devices. Wound dressings, some 18 types of treatment being tried. In view of indications given in these trials that durability is a more desirable quality in a wound dressing than rate of callus growth the bordeaux and linseed oil mixture appears to be the best. It has the disadvantage of not remaining in good condition very long after mixing, but the great advantage of being a good disinfectant and of requiring only one application.

* cf. however abstract 1244.

Scab control. Insects including the gypsy moth (*Porthetria dispar*), apple fruit fly (*Rhagoletis pomonella*), plum curculio (*Conotrachelus nenuphar*) and apple seed chalcid (*Syntomaspis druparum*). Garden crops. Lettuce, tomato, cucumber, boron deficiency in cauliflower, the striped cucumber beetle (*Diabrotica vittata*). Small fruits. Variety trials of strawberries, raspberries and grapes. Blueberry pollination, breeding, burning, weeding, fruit fly, thrips and flea beetle.

1360. MASSACHUSETTS.

634/5

Annual report for the fiscal year ending November 30, 1937.

Bull. Mass. agric. Exp. Sta., **347**, 1938, pp. 99.

For a station not devoted entirely to horticulture the Massachusetts Station seems to turn out a great deal of work interesting to horticulturists. The work done in 1937 is summarized briefly and clearly in this annual report. Among investigations noted are the following : *Dep. Agricultural Engineering*. Cold storage of cranberries. Minimum losses occurred where storage was at 35° F., but green berries can be coloured best at 45°. Apple storage, particularly refrigerating plants using low pressure gases such as methyl chloride with blowers equipped with copper fin-type coils. *Dep. of Botany*. Soil temperature effects. Control of soil infesting organisms. Growth of cuttings with special reference to the time of taking and the relation of season to response to treatment. Soil surface treatment in hotbeds with chemicals. Greenhouse diseases. Vegetable seed treatments. *Dep. of Chemistry*. Nutritive value of copper, zinc, chromium and molybdenum. *The Cranberry Station*. Incidence and control of the following pests : grape anomala (*Anomala errans*), weevil (*Anthonomus* sp.), fire beetle (*Cryptocephalus incertus*), fruitworm (*Mineola*). Control of bog weed. Relationship of time of ripening to storage properties. Breeding for resistance to false blossom. Spraying to control rose-bloom. Blueberry disease. *Dep. of Entomology*. Most of the pests under examination are horticulturally important. *Dep. of Floriculture*. Snapdragon breeding. Nutrition of gardenias. Propagation of gardenias and geraniums. Temperature for forcing lilies. *Dep. of Horticultural Manufactures*. Cranberry products. Apple products. Nutritive values of frozen food. Ascorbic acid in tomato juice as affected by maturity, variety, etc. *Dep. of Horticulture*. Perennial asters. Transplanting and packing hardy plant material. Vegetative propagation of apple. *Dep. of Olericulture*. Water requirements of vegetable crops. Vernalization of vegetable crops. Celery storage. Vegetable breeding. *Dep. of Pomology*. Apple clonal rootstocks. Most of the Malling stocks grew well from root cuttings taken from 2-year-old nursery trees. All attempts to root hardwood cuttings with and without treatment with hormones failed. Genetic composition of peaches. Cultivation systems in bearing apple orchards. Effects of potash and lime on apple trees. Fruit bud formation in the strawberry. Elimination of spray residues. Blueberry culture and nutrition. Premature apple drop. Colouring of apples after harvesting.

1361. MYSORE. (MAYNE, W. W.)

633.73

Annual Report of the Coffee Scientific Officer, Department of Agriculture, Mysore State, 1937-8, 1938, pp. 17, being *Bull. Mysore Coffee Exp. Sta.*, 17.

Attention is mainly paid to the study of the black bean disease which has been greatly on the increase on some estates. Attention is focused on the inner silver skin layer covering the bean. Through this tissue food materials and water pass into the bean during the later stages of development. Normally this breaks down during the maturing of the bean. In defective beans this tissue does not appear to break down in the normal way but retains the structure of an active tissue which in many cases will start to proliferate and cause complete breakdown in the bean tissues. In other cases there is no obvious change in the bean tissue but the silver skin persists. These defects seem to be due to a disturbance of the moisture and nutritive supply of the bean during a comparatively late stage of development. The study is being continued on the course of development of the bean with special reference to the monsoon period and the study of the water relations of the coffee plant during the same period.

1362. NEW ZEALAND, D.S.I.R.* 634+664.85.037
Fruit research and fruit cold storage.
Annu. Rep. Dep. sci. ind. Res. N.Z. 1937-38, 1938, pp. 40-9, also issued separately.

Fruit research in New Zealand continues to be carried on as a co-ordinated series of projects divided among different bodies including the D.S.I.R. and the Horticultural Division of the Department of Agriculture. In this report the salient features of the work in progress are noted. *Apples.* Fertilizer experiments including effect on growth, cropping and storage of a number of varieties. Rootstock experiments include Northern Spy, Double Vigour, Large's seedling and Malling stocks I, XII, XIII, XV and XVI. The partiality of scion varieties for particular stocks is becoming evident. Inarching experiments for the invigoration of old trees are in progress as also pruning and varietal trials. Entomological workers are mainly concerned with biological control of a number of pests. Mycological studies concern mouldy core, eye rot, silver leaf, canker, crinkle and black spot. Work on spraying at Havelock North is reported in the *Orchardist*. Other spraying trials are noted here. The part played by boron in a number of physiological disorders is being investigated. A scheme for certification of therapeutics is now in active operation. *Stone fruits.* Investigations have included varietal and fertilizer tests and work on silver leaf and brown rot. *Small fruits.* Forty-five varieties of currants, gooseberries and raspberries from England are now under trial. Strawberry root rot is under investigation. Of pests raspberry bud moth (*Carposina adreptella*) and sawfly (*Priophorus tenes*) are being studied. *Citrus.* In fertilizer experiments statistically significant crop results were obtained by the use of lime for lemons. Rootstock experiments include sweet and sour orange, citronelle and trifoliata. Citrus blast and canker have been identified as *Pseudomonas Syringae* and *P. Citri* respectively. Mottle leaf symptoms have not yielded to zinc treatment as in the U.S.A. but promising results have been achieved with manganese and trials with this element continue. Lemon curing is being studied. *Fruit juice.* A series of tests has been initiated to determine the suitability of various methods of manufacture for New Zealand apples. *Cold storage.* In experimental consignments of apples shipped to England in the 1937 season the following points were studied: (1) influence of position on tree on incidence of storage disorders in Cox's Orange Pippin, (2) effect of precooling on incidence of storage disorders, and (3) influence of different types of wrapper on incidence of storage disorders. The conclusions reached are given here. A demonstration shipment of nearly 50,000 cases of apples on the "no dunnage" system of stowage was carried to London by one of the modern vessels and proved completely successful in that the fruit apart from normal bruising was in excellent condition at discharge. A trial of oiled wraps versus plain wraps for apples showed that except for better control of superficial scald in such varieties as Granny Smith and Rome Beauty the oiled wraps were not superior. Tests of copper sulphate treated wraps for controlling the spread of grey mould in pears have so far been inconclusive. The addition of nitrogen in the orchard to some 5 apple varieties resulted in all cases in increased susceptibility to breakdown in store. Notes on other effects are discussed. Gas storage trials at various concentrations and temperatures with Washington and Ballarat apples were not entirely satisfactory owing to the too advanced state of the fruit at the time of storing. On the whole the gas stored sound fruit were firmer, less ripe, more juicy and of better flavour than the controls. Initial and promising trials of cool storing asparagus at 33° F. will be repeated. Cool storage of peas in the pod was found possible for 4 weeks. Storage in 10% CO₂ checked mould growth and retarded loss of flavour. Notes are given on work to be undertaken in 1938.

1363. NEW ZEALAND. 634/5
Annual report of the Department of Agriculture for 1937-8, 1938,
 pp. 62.

Much of the detail given in the report of the Division of Horticulture (pp. 52-6) is also contained in the report of the D.S.I.R. (see previous abstract) and will be omitted from these notes. The Te

* Department of Scientific and Industrial Research.

Kauwhata Horticultural Station shows a satisfactory balance sheet and public interest in vine growing both for table grapes and wine continues to increase. Notes are given of tobacco growing and production for export. The original plantations of tung trees in the North Auckland district amounted to 5,500. It appears doubtful whether any of them will be commercially successful under present conditions. No further planting is being done.

1364. NIGERIA.

634.6

Annual Report of the Department of Agriculture, Nigeria, 1936,
pp. 43, 3s. 6d., issued as *Sessional Paper No. 1 of 1938.*

Oil palms. Experiments have shown that germination can be greatly accelerated by some form of heat treatment, provided that the seeds are kept damp. Satisfactory make-shift heating can be obtained by heating the germinating trays or by treatment in a smoke house. At Abeokuta exceptionally good results have been obtained without heating by using seed from over-ripe bunches. It is certain the seed of some oil palms germinates more freely than seed from others and probable that seed from young trees germinates less freely than seed from old trees. It has been found necessary to raise the germination trays on legs as a protection against ants. This, however, allows heat to be applied beneath the trays. Some data have been obtained on the inheritance of fruit type. Self-fertilized hard-shell palms have given 95.5% hard-shell and 4.5% soft-shell; soft-shell palms self-fertilized have given 56.6% soft-shell and 43.4% hard-shell palms. Self-fertilized green-fruited palms have given 67.8% green-fruited and 32.2% non-green-fruited palms. The percentage of true to type palms from naturally pollinated seed is variable and in general much lower than from self-pollinated seed.

1365. PALESTINE.

634.1/8

**Annual Report of the Department of Agriculture and Fisheries
for the year ended 31st March, 1937, 1937,** pp. 109, Jerusalem, 100 mils.

The Chief Horticultural Officer's report will be found on pp. 75-96. The following subjects are considered: The citrus industry, fruits other than citrus, horticultural experimental stations, horticultural demonstration plots, work of field officer, research, and finance. Among horticultural research items the following will be of interest. Work was carried on at nine horticultural experimental stations. Propagation of apple and pear cuttings was not very successful. In table grape trials some varieties came into bearing and several show promise. Banana experiments on planting distances and cultivation practices were planted up at the Jericho station. As regards stocks for Shammuti, trees on sweet lime are developing poorly and the leaves are yellowing, girth measurement 20 cm. above ground is 32.1 cm. and yield about 148 fruits a tree. Those on sour stock are growing well with a girth measurement of 36 cm. and fruit production of 95 per tree. Those on rough lemon are best with a girth measurement of 42 and yield of 140 fruits per tree. All Shammuti budded on grapefruit died. At Nablus the sudden failure of a number of plums, almonds and apricots on almond stocks, 2 apricots on apricot and 16 cherries on mahaleb suggests that the soil may be too retentive for these stocks. Vine training and pruning experiments are in progress at the Farradiya station. Various species are being tested as windbreaks at most of the stations. They include *Cupressus pyramidalis*, *C. horizontalis*, *C. arizonica*, *Grevillea robusta*, *Ficus nitida* and *Poinciana regia* and others. The study of almond seedling stocks shows wide variation. Khashali stocks are being studied for pome fruits and so called Qarassya and Suwaydah for stone fruits. In addition Indian stocks from the Punjab are being propagated at Acre. The usual mounding v. etiolation method has at Acre produced many stocks too thick for propagation purposes. In an endeavour to produce thin shoots the effect is being tried of (1) growing the mother plants in nurseries in the mountainous areas where development is slower and (2) growing mother plants in the plain nurseries and pruning back hard during February, April and June to check development. A study was made of the effect of weight, shading, and disinfection on the rooting of date offshoots. Preliminary results show that heavier offshoots gave the best results, shading the beds had no effect, disinfecting by dipping and/or spraying was efficacious. There was indication of success from heating the propagation

bed with an electric cable. The effect of cypress windbreaks was 4·4% dropped fruit as against 8·5 controls and an appreciable gain in first quality fruit.

The report of the chief plant protection officer is also interesting. The outstanding pests in 1936/7 were the mediterranean fruit fly, and the mussel scale, while the plum sawfly would appear to be more widespread than was previously supposed. Research was undertaken on the black scale (*Chrysomphalus ficus*) on the mediterranean fruit fly in the coastal plain, Acre and the Jordan Valley, the control of *Polychrosis botrana*, on various insecticides and on resistance of wild almond stocks.

1366. SAANICHTON, B. C. (STRAIGHT, E. M., Supt.) 634/5
Experimental Station Saanichton B.C., Results of experiments 1932-6 inclusive, 1937, pp. 54.

This brief account of 5 years' work at the Saanichton Station is useful as giving the outsider an idea of the problems of agriculture on Vancouver Island. Horticulture is the paramount interest. Pears are the best of the tree fruits in the southern part of the island, the chief outlet being the cannery, and are followed by the sweet cherry, considerable trouble being experienced with the latter crops from blossom blight. Pollination studies have been in progress for varying periods with pears, cherries, plums and apples. Fertilizer experiments using different amounts of sodium nitrate on Beurré d'Anjou pears and Cox's Orange Pippin apples are reported for a six-year period. Briefly the chief results are: nitrate increases rate of growth in both cases, but the application of excessive amounts of 32 lb. a year did not increase growth over the lower rates. There were no indications of deterioration in storage quality of apples as the result, but in pears it was definitely affected, thus in 1935 pears from plots receiving the maximum amount, i.e. 32 lb., had a storage life of only 80 days as against 119 for the control trees. As regards nuts, walnuts, filberts and sweet chestnuts show promise, but attempts to grow almonds and pecans have been unsuccessful. Work on strawberries during the period was confined entirely to propagation and breeding work. The following bush fruits are under examination:—Boysen berry, Young berry, loganberries and blackberries. Tomato fertilizer trials are in progress. Other investigations comprise paper mulching, the effect of X-ray seed treatment and evergreen and deciduous ornamental trees and shrubs. Flowers including tulip growing and stocks (*Matthiola* sp.). Vegetables including broccoli and melons.

1367. SIERRA LEONE. 633.825 + 664.85.323
Annual Report of the Department of Agriculture, Sierra Leone for 1936, 1937, pp. 65.

Ginger. No significant difference in total yield was found between ginger on the flat and ginger in raised beds. The highest yields were obtained from the native method of close planting on the flat, 26·3 sets per square yard, and close planting on raised beds, 18·2 sets to the square yard. The other less successful spacings were all wider. The highest profits, nearly double the next best, were obtained from 6 in. × 9 in. on the flat, and close planting on raised beds. *Grapefruit colouring and storing*. The different ethylene colouring methods in use in a number of producing countries were tried and compared. The method recommended as a result is a 1 : 10,000 concentration for 8-12 hours, ventilating between doses, of which 2-4 may be required according to season. Removal of the buttons immediately after colouring reduced stem end rot by over 75%. Treated fruit stored in moist sawdust was still fresh and firm at the end of 3 months with a loss by rotting of 5 out of 125. Somewhat similar results were obtained with storage in moist sand the loss here being 5 out of 135 fruits.

1368. SOMALILAND. 633.81
Annual Report of the British Somaliland Veterinary and Agricultural Department for 1937, pp. 29, stencilled.

There are some interesting notes on the production and marketing of myrrh, frankincense and gum arabic (*Balsamodendron Myrrh* Nees., *Boswellia Carteri* Birwood, and *Acacia Verek*) in Somaliland. At present there is no cultivation of the trees, which are seldom free from the

attentions of the collectors except in areas where for one reason or another trees are not tapped at all. There is at present no knowledge of the scientific working of plantations or of the correct method of resting or tapping incense trees. The gum arabic is marketed in the most uneconomical way and the natives are too conservative to change. Inquiries of the Italians as to methods taken to improve their plantations have been unfruitful.

1369. SOUTH AFRICAN CO-OPERATIVE DECIDUOUS FRUIT EXCHANGE. 634.1/7 : 382.6
Annual Report of the Overseas Representative—Season 1937-8,
 1938, pp. 116.

Particulars of the fruit exported from South Africa to European countries in the 1937-8 season are given in this report for apples, apricots, grapes, melons, nectarines, peaches, pears, pineapples and plums. Notes are given of prices obtained, of competition experienced and of the state of the fruit on the English market. As regards competition the following notes may be of interest : *Stone fruits.* Shipments of Australian plums declined, Argentine shipments increased slightly and small consignments of nectarines and peaches arrived from Chile in February but were of poor quality. *Grapes.* There was a decline in Spanish grapes and a marked increase in Californian. The amount of Argentine grapes sent to the U.K. increased and Chile entered as a serious competitor. *Pears.* Considerable competition was met with from U.S. pears in the period January to March. Argentine shipments also increased greatly. *Apples.* Competition was less severe than usual. *Pineapples.* Competition was as before largely confined to St. Michael's pineapples from the Azores. Shipments were also made to Germany, Holland, France, Switzerland and the Scandinavian countries and three experimental shipments totalling 1,900 trays of plums and prunes, 850 peaches, 100 nectarines and 200 cases of pears were sent to Canada from Southampton in January and February 1938. The shipments to Canada resulted in a net loss of £122. Small shipments to the U.S.A. are also recorded.

1370. STRAITS SETTLEMENTS AND FEDERATED MALAY STATES. 633/4
Reports of the Field Branch for the year 1937.
Gen. Ser. Bull. Dep. Agric. S.S. & F.M.S., 30, 1938, pp. 171, cents 50 (6d.).

These reports deal with the general agricultural position and the work done by the Agricultural Departments in the various districts. Only such information as is not readily available in other departmental publications is included in this bulletin.

1371. TANGANYIKA TERRITORY. 633.73
Third Annual Report Coffee Research Experimental Station, Lyamungu, Moshi, for 1936, 1937, pp. 90, S3, being *Pamphl. Dep. Agric., 19.*

Correlations of bean characteristics. Correlation co-efficients on samples of beans from individual trees have been worked out in order to find whether any one measurement would be sufficient to characterize the beans of any one tree. The following facts emerged. Heavy yielders do not necessarily give light beans nor small beans, in fact there is a slight tendency for good yielders to give heavier and larger beans ; long beans are not necessarily flat beans or narrow beans ; long beans are generally heavy beans ; wide beans have some positive correlation with weight, flat beans are usually lighter beans ; width and boldness of beans is little correlated. That is to say, heavy yielders are just as likely to have large heavy beans as poor yielders. The above forms part of a quantity of data collected during the preliminary investigations necessary to obtain information on which the work of selection can be based. *Vegetative propagation.* Many methods of vegetative propagation have been tried, the most successful being the rooting of softwood cuttings in propagating cases without bottom heat. The most suitable type of softwood cutting is from 4-6 inches long taken from terminal shoots of unshaded plants. The results and difficulties experienced with the other types of propagation are described. *Plot size.* After investigations the twenty-tree plot has been chosen as the most suitable size for experiments

on estates. *Erosion demonstration.* Various treatments with hedge and cover crops almost completely controlled erosion, but the coffee plants on the untreated eroded control plots were considerably better than those on the treated plots. This is ascribed to differences in soil moisture content. Methods of erosion control which do not deplete the soil moisture in districts liable to droughts of two or three months duration are suggested. *Investigation on field problems.* Overbearing, yellowing and dieback in West Arusha are attributed to a lack of balance in nutrition between nitrogen and potassium. Non-fruiting in Mufindi is attributed to a soil over-rich in nitrogen. The report concludes with notes on some coffee diseases.

1372. TANGANYIKA TERRITORY.

633.73

Fourth Annual Report Coffee Research Experimental Station, Lyamungu, Moshi, for 1937, 1938, pp. 55, S1.50, being Pamphl. Dep. Agric., 22.

Recording on numerous selected trees is now in its fourth successive year. Some have proved erratic in yield. Less than a dozen have never fallen below a yield of 200 ounces in any one year. Examination of bean characteristics has been simplified. A random sample of 350 beans from the whole crop of any one tree together with weight of bean gives the bulk of the information required. One of the principal aims of the station is stated to be the mass propagation by vegetative means of trees selected for desirable qualities. Bulk material for cuttings is most readily obtained from multiple stem trees. The average time for rooting cuttings in a propagator is 18 weeks. The application of growth substances seems to have accelerated the rooting of semi-hard wood cuttings but not of soft wood cuttings. Soil investigations draw a contrast between a mulch highly resistant to decomposition in the field, e.g. banana trash, which is beneficial, and one which breaks down fairly readily and is possibly harmful. Banana trash mulching has been found to have kept the soil moisture of the top foot of soil 12% higher than that of the bare soil after 3 months of drought. It is an entirely effective method against erosion.

1373. TANGANYIKA TERRITORY.

633.526.23

Sisal Experimental Station Report for 1937, 1938, pp. 19, 6d., being Pamphl. Dep. Agric., 20.

The station has been established too recently for any tangible results to have been obtained from the many field experiments in progress but information is being acquired from the growth studies of young sisal under various cultural conditions. These conditions are surface clean weeding, clean weeding and deep cultivation, weeding twice yearly, cover cropping, cutlassing weeds, leaving weeds uncontrolled. In both the increase in number of leaves and increase of leaf length the surface clean weeding has proved the most successful. The unweeded plots, a normal condition of many estates, have shown both restricted growth and impaired fibre quality. Deep cultivation caused a slight check when the plants were small but not on subsequent occasions; the plants, however, a year later had not fully recovered. An outcome of clean weeding (a treatment which, incidentally, implies measures against erosion) is that the 20th and subsequent leaves will shortly be ready for cutting whereas the 40th leaf of the unweeded plots is hardly good enough.

1374. UGANDA PROTECTORATE.

633.73 + 633.85

Annual Report of the Department of Agriculture of Uganda for the year ended June 30th, 1937, 1938, pp. 125, S4.50.

Much of the report deals with cotton with which this Bureau is not concerned. *Coffee.* Vegetative propagation by means of large woody cuttings inserted in nursery beds and kept shaded and watered has given fair success. This was the common method of propagation by natives in Uganda before the advent of the European. It was found that the process of drying coffee was not continuous, moisture lost during the day being often regained during the night, and to obviate this it is suggested that drying coffee should be kept in a closed place at night.

Soils of neutral reaction appear to produce more robust and vigorous arabica coffee than those with definitely acid reaction. Tung oil, *Aleurites montana* and *A. Fordii*, do not grow sufficiently well in Uganda to be of commercial importance. *Aleurites moluccana* (*A. triloba*), the candlenut, grows and fruits well, but a report on its oil shows that it would not be commercially profitable.

1375. U.S. DEPARTMENT OF AGRICULTURE. 634.4
Soils and men. Yearbook of Agriculture, 1938, 1938, Supt. Documents,
 Washington, D.C., pp. 1232, \$1.75.

The whole of the 1938 yearbook of the U.S. Department of Agriculture is devoted to soil and manurial problems. There are many articles which indirectly concern horticulturists, e.g. those dealing with erosion, dry land farming, irrigation, drainage and water relations. To the layman a glossary of special terms used in the yearbook on pages 1162-80 should prove of considerable use.

1376. WASHINGTON. 634/5
Proceedings of the 33rd Annual Meeting of the Washington State Horticultural Association, 1937, Wenatchee, Wash., 1938, pp. 189.

Subjects discussed at the annual meeting of the Washington State Horticultural Association include the following: Collection and artificial application of pollen. Maturity studies of soft fruits (sweet cherries, apricots and peaches) sweet cherry products (juice, syrup, jam—mixed with sour cherries). Maintenance of organic matter in orchards. Boron (a brief review of boron deficiency troubles of walnuts, apples and pears and the treatment found useful. It is noted that neither cork spot nor black end of pears would appear to be boron deficiency diseases). Irrigation problems (significance of frequencies and amounts of irrigation water applied to orchard as related (1) to soil moisture and (2) to tree and fruit response). Sprays (substitutes for lead arsenate, inverted spray mixture, chemistry of sulphur sprays). Spray and washing injuries to apples and pears (calyx end, spot type, lenticel and heat injury). Spray residues (a plea is made for a more "reasonable" attitude of the Government with regard to the amount of arsenical residues permissible on fruit in the market in view of the fact stated that no one has yet been hurt by eating sprayed apples and that, since nearly all foods contain lead or arsenic or both, the apple should not be singled out for particularly drastic restrictive treatment).

1377. ZANZIBAR. 633.832 + 634.61
Annual Report of the Department of Agriculture of Zanzibar for 1937, 1938, pp. 30, 2s.

Cloves. Copra kilns were on occasion used for drying cloves on account of excessive rain. Cloves so dried could only be distinguished from sun-dried cloves on critical examination by their faint green colour. *Coconuts.* Seed selection was continued. Desirable characteristics of seed parents are: large numbers of visible nuts evenly distributed around the crown, large numbers of visible immature nuts, buttons and flowering spathes similarly distributed, short flower stalks, wide open crowns with evenly distributed fronds; other approved factors were absence of immature nut fall, freedom from gummosis, and if possible a knowledge of the palm's previous history. This last was often supplied by professional palm climbers who had a general mental record of past performances of most of the trees.

1378. The annual reports mentioned below have also been examined. Much of the research referred to in them has been dealt with more fully elsewhere and abstracted in Horticultural Abstracts.
Rep. Dep. Agric. Antigua for 1937, 1938, pp. 52.
Forty-eighth annu. Rep. Arizona agric. Exp. Sta., Tucson, for the year ending June 30th, 1937, pp. 101.

- 1378 *Annu. Rep. Dep. Agric. Assam for the year 1936-7*, 1938, pp. 153 + supplement pp. 3, 2s. 6d.
- Agricultural Statistics Rep. Province British Columbia for 1937*, Victoria, B.C., pp. 45.
- Administ. Rep. Director Agric. British Guiana for 1937*, 1938, pp. 43.
- Rep. agric. Stas of Dep. Agric. Burma for the year ended March 31st, 1937*, 1938, pp. 223, 9s.
- Ceylon. *Rep. Work Rubb. Res. Board in 1937*, 1938, pp. 76.
- Ceylon. *Annu. Rep. Tea Res. Inst. for 1937*, pp. 94, being *Bull.* No. 18.
- Annu. Rep. Director Delaware agric. Exp. Sta. for fiscal year ending June 30th, 1937*, Newark, Delaware, pp. 46.
- Rep. agric. Dep. Dominica for 1937*, 1938, pp. 33, 6d.
- Rep. Dep. Agric. Gambia for year ending May 31st, 1937*, pp. 17, 2s.
- Forty-ninth annu. Rep. Georgia Exp. Sta. for the year 1936-7*, 1937, pp. 69.
- Rep. Dep. Agric. Gold Coast Colony, 1936-37*, 1937, pp. 21, 2s.
- Annu. Rep. Supt Bot. for Dep. Hong Kong for 1937*, pp. 15.
- Rep. Operations Dep. Agric. Madras Presidency for the year 1936-7*, pp. 58 and supplement pp. 6, annas 8.
- Malayan Agricultural Statistics, 1937.* (GRIST, D. H.)
- Econ. Ser. Bull. Dep. Agric. S.S. and F.M.S. 9*, 1938, pp. tab. 96, \$1.00.
- Annu. Rep. Dep. Agric. Malaya for 1937*, 1938, pp. 81. (FAULKNER, O. T.)
- Annu. Rep. Govt Gdns Dep. Mysore. for the year 1936-7*, 1938, pp. 56.
- Fifty-first annu. Rep. agric. Exp. Sta. Nebraska.* Lincoln, Nebraska, 1938, pp. 67.
- Annu. Rep. Dep. Agric. N. Rhodesia for 1937*, 1938, pp. 23, s. 2.
- Fiftieth annu. Rep. Pennsylvania agric. Exp. Sta. for fiscal year, ended 30 June, 1937*, being *Bull.* 352, pp. 69.
- Annu. Rep. Dep. Agric. Seychelles for 1936*, 1938, pp. 30.
- Rep. Minister Agric. S. Australia for the year ended June 30th, 1937*, pp. 72.
- Sudan Dep. Agric. For., annu. Rep. Agric. Res. Scheme for 1936*, pp. 102.
- Field experiments on sugar cane, Trinidad. (TURNER, P. E.)
- Annu. Rep. for 1937*, Sugar-Cane Investigation Cttee, Trinidad, pp. 95.
- Annu. Rep. Dep. Agric. Tanganyika Territory, 1937*, Part I, 1938, pp. 46, 2s. 6d.
- Rep. Gen. Exp. Fms Tanganyika for 1937*, 1938, pp. 39, (Pamphl. 21.)
- TRINIDAD AND TOBAGO.
- Administ. Rep. Director Agric. for 1937*, 1938, pp. 81, 60 cents.
- IMPERIAL COLLEGE OF TROPICAL AGRICULTURE, TRINIDAD.
- Rep. for year ended August 31st, 1937*, 1938, pp. 38.
- Forty-seventh annu. Rep. Washington Agric. Exp. Sta., Pullman, Wash., for the fiscal year ended June 30th, 1937*, being *Bull.* 354, pp. 89.

1379. ROACH, W. A. 581.111 : 632.19 : 634.1/7
Plant injection for diagnostic and curative purposes.
Tech. Comm. Imp. Bur. Hort. Plant. Crops, **10**, 1938, pp. 78, bibl. 162, 5s.

The author first deals with previous work on the subject of plant injection and the different theories accounting for success and lack of success. He then discusses in considerable detail modern work on the subject describing his own experiments on fruit trees at East Malling and elsewhere. He explains in detail with illustrations and diagrams the methods used and reviews the prospects opened up by these methods not only for the diagnosis but also for the cure of physiological disorders due to nutritional factors.

1380. P.E.P. 63 : 581.08
Report on agricultural research in Great Britain.
 P.E.P. (Political and Economic Planning), 16 Queen Anne's Gate, London, S.W.1,
 pp. 146, 8s. 6d.

The organization producing this report describes itself as an "independent non-party group", consisting of more than 100 working members of various professions and industries. Its aim here is "to examine the adequacy of the provision made for agricultural research in Great Britain, how it is administered and to what extent the present machinery for getting the results of research across to the farmer is successful".

No technical details or problems are dealt with, but the administrative and institutional structure of agricultural research in this country and its finance and personnel are considered. The provisions for disseminating results are also discussed and current research work is briefly surveyed. Seven appendices contain particulars of the agricultural institutions of Great Britain and Northern Ireland and a short description is also given of research in Northern Ireland, U.S.A. and Denmark. Finally reasoned criticisms are presented and remedies proposed for the defects discovered.

Eight aspects of research and its ancillary services are distinguished. They are classified as follows: A. *Research activities*, consisting of (1) background research or enquiry into fundamental laws; (2) basic research, or the study of broad subjects with a pronounced practical bearing, but without the express object of attaining immediate practical results; (3) *ad hoc* research, or the study of specific practical problems; (4) pilot research bridging the gap between laboratory experiment and commercial practice. B. *Ancillary services*, divided into (5) information service for the pooling of data between research workers, agricultural advisors, etc.; (6) extension work, which spreads scientific knowledge among farmers and brings the farmers' problems to the attention of the research worker; (7) public relations work in which organized research popularizes its results by methods of mass publicity; and (8) training of personnel for the above services. The farmers' grievances are stated. They are that the research worker is out of touch with farming needs and conditions, that results of research are inaccessible and unintelligible, that objects of research are chosen haphazard, that the extension service seldom provides a prompt answer to questions and then exhibits an excess of self-preservative caution, that there are no official demonstration farms, that there is no quarter to which suggestions for research can be sent with the certainty of a sympathetic reception. The research worker's answer is presented fully enough to show that he could spread his wings to some purpose were he once extracted from the red tape cocoon in which he is at present encased. How this extraction can be accomplished is discussed.

It is suggested that the Development Commission is superfluous and should be eliminated, and that its remaining functions should be transferred to the Agricultural Research Council, which should have executive powers to plan, co-ordinate and distribute the results of research. The system of research institutes devoted to particular sciences is fairly satisfactory but there would seem to be a good case for establishing also a series of institutes on the lines of those at Cheshunt (Glasshouse) or Aberystwyth (Welsh Plant Breeding—Grassland), each devoted to the husbandry of particular animals or crops or groups thereof. Official research directors under the A.R.C. would be required to co-ordinate research "without inspection or interference with the work

of the institutes" unless, of course, they did not conform. To well-behaved institutes they would give "encouragement".

Further it is urged that the appointment of provincial advisors should be on a husbandry rather than a scientific basis, and that the county advisory and agricultural education services should be placed under the control of agricultural colleges. The Imperial Institutes and Bureaux are insufficient and a series of bureaux organized on a husbandry basis is wanted. But surely some of us Bureaux are already given to husbandry? The reader has only to glance at our "technical communications" or turn back a page or two in these abstracts to read to his fill on the practical application of science to horticulture—we almost said husbandry.

On the financial side research stations are urged to commercialize their wares, and the farming community is bluntly informed that it contributes strikingly little towards the cost of research which is primarily for its own benefit. The same applies to subsidiary industries and they together with local authorities, universities and private individuals might also be "touched" for funds. To prevent directors of research stations being forced to expend all their time performing this delicate operation the establishment of a central agricultural research fund for the collection and allocation of contributions is urged. Whether benefactors to a common fund would come forward so readily is only one of the snags which leaps to the mind in this connexion. The poorness of pay and prospects on the establishment side is noted and in this respect agriculture compares unfavourably with other branches of state-aided research. Our own opinion too, and, maybe, the same thought occurred to Adam!

It is suggested that a new Central Extension Service under the control of the A.R.C. should be formed to disseminate scientific knowledge on agriculture. It would be responsible for all official agricultural literature and might launch a series of semi-popular journals on a husbandry basis. But does not the Ministry of Agriculture with its journal and new series of very readable bulletins already fill the bill quite adequately?

It is almost inevitable that in the first edition of such a report certain slight errors of facts should creep in and this report is no exception. Such blemishes will, however, doubtless be removed in any future edition and even now they do not appreciably detract from the value of a well-balanced and unbiased survey. Though few will subscribe to all the author's cures, a perusal of his diagnoses cannot but be instructive.

